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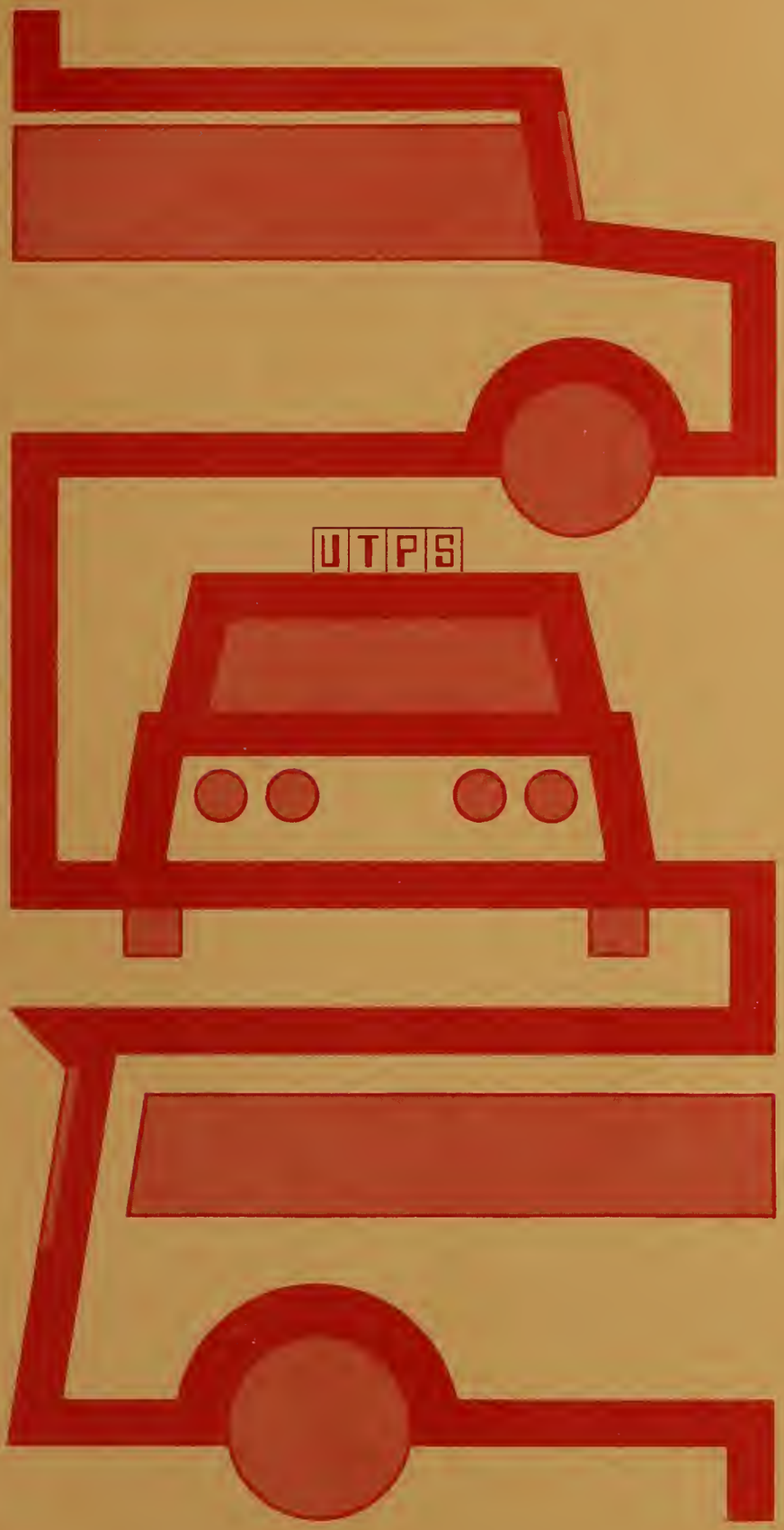


# analyzing transit options for small urban communities

VOL I

## transit service objectives and options

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16. Abstract

This manual provides an analytical framework and supporting analytical techniques to assist in the analysis of transit options for small urban communities. It is intended for use principally by planners and decision-makers in communities with less than 200,000 residents, but many portions would be useful in larger urban areas as well. Sufficient information is provided in the manual to permit the small urban community to conduct its own analysis without resorting to outside assistance.

The information and analytical techniques contained in this manual are presented in three volumes. In this volume, Volume One, Transit Service Objectives and Options, the structure, content, and applicability of the manual is set forth, a general approach to analyzing transit options in small urban communities is described, the specification of local transit service objectives is discussed, and information to assist in the formulation of transit service opportunities is presented.

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# ANALYZING TRANSIT OPTIONS FOR SMALL URBAN COMMUNITIES

## Volume One:
## Transit Service Objectives and Options

Prepared by

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In Association with
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January 1978

Prepared for

U. S. Department of Transportation
Urban Mass Transportation Administration
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# FORWARD

Today's transportation planner must confront ever-changing issues within a variety of working environments. To assist him, UMTA's Planning Methods and Support program researches, develops, and distributes planning tools, including the documentation of novel planning studies, new design and forecasting techniques, and germane research results. This report is one example. Prepared by recognized experts, its content clearly presents usable planning concepts, and thus constitutes a valuable addition to the growing set of computerized and manual techniques comprising the UMTA/FHWA Urban Transportation Planning System (UTPS).

More important than the production and dissemination of a new tool is the experience and opinion of its user. Local issues change. Better methods evolve. Or, realistically, errors may appear in the final product. We depend on you, the transportation planner, to alert us to any of the above. We need your comments and your ideas. Please let us hear them, so we can continually improve our products.

You may obtain additional copies of this report from the National Technical Information Service (NTIS), Springfield, VA, 22101. On your request, please reference IT-06-9020-78-1.

Robert B. Dial, Director
Office of Planning Methods
and Support (UPM-20)
Department of Transportation
Washington, D. C. 20590

# ABSTRACT

This manual provides an analytical framework and supporting analytical techniques to assist in the analysis of transit options for small urban communities. It is intended for use principally by planners and decisionmakers in communities with less than 200,000 residents, but many portions would be useful in larger urban areas as well.

The procedures and techniques presented in the manual are oriented to state and local planners and decisionmakers who are called upon to analyze transit options but who have limited data and time to perform these analyses. Sufficient information is provided in the manual to permit the small urban community to conduct its own analysis without resorting to outside assistance. At the same time, modifications, embellishments, and improvements to the procedures and techniques set forth in this manual are encouraged should local data or past analyses suggest more appropriate methods.

The information and analytical techniques contained in this manual are presented in three volumes. Volume One, Transit Service Objectives and Options, contains the first four chapters:

- Chapter I - Introduction
- Chapter II - A Procedure for Planning Conventional Transit and Paratransit Service in Small Urban Communities
- Chapter III - Identifying Objectives for Local Transit Services
- Chapter IV - Formulating Transit Service Opportunities

In these four chapters the structure, content, and applicability of the manual is set forth, a general approach to analyzing transit options in small urban communities is described, the specification of local transit service objectives is discussed, and information to assist in the formulation of transit service opportunities is presented.

Volume Two, Analysis Methods, contains the fifth chapter of the manual:

- Chapter V - Evaluating Transit Service Alternatives

In this chapter, an evaluation approach is described and detailed techniques are presented with which one can estimate the patronage, cost, and revenue

implications of a transit service operation; these are three key elements in the evaluation of transit service alternatives.

Volume Three, Summary of Management and Operations Experience, contains the last two chapters of the manual:

- Chapter VI - Planning for Transit Management and Operation
- Chapter VII - Transit Experience in Other Urban Communities

These two chapters describe the activities of a transit operation, explore the relations between these activities, identify arguments for and against local control of transit organizations, and provide numerous data and statistics that characterize the financial and operating performance of existing conventional transit and paratransit services in small urban communities.

TABLE OF CONTENTS


| Chapter | | Page |
|---|---|---|
| I | INTRODUCTION | I.1 |
| II | A PROCEDURE FOR PLANNING CONVENTIONAL TRANSIT AND PARATRANSIT SERVICE IN SMALL URBAN COMMUNITIES | II.1 |
| | A. Introduction | II.1 |
| | B. The Nature of the Transit Planning Process | II.2 |
| III | IDENTIFYING OBJECTIVES FOR LOCAL TRANSIT SERVICES | III.1 |
| | A. Introduction | III.1 |
| | B. Goals, Objectives, Standards, and Criteria | III.1 |
| | C. Inventory of Existing Conditions | III.15 |
| IV | FORMULATING TRANSIT SERVICE OPPORTUNITIES | IV.1 |
| | A. Introduction | IV.1 |
| | B. Transit Service Options | IV.1 |
| V | EVALUATING TRANSIT SERVICE ALTERNATIVES | V.1 |
| | A. Introduction | V.1 |
| | B. Cost-Effectiveness Analysis | V.3 |
| | C. Demand Analysis Methods | V.9 |
| | D. Financial Evaluation Methods | V.105 |
| VI | PLANNING FOR TRANSIT MANAGEMENT AND OPERATION | VI.1 |
| | A. Introduction | VI.1 |
| | B. Nature of the Transit Organization and Its Relation to Other Organizations | VI.2 |
| | C. Internal Structure of the Transit Organization | VI.7 |
| VII | TRANSIT EXPERIENCE IN OTHER URBAN AREAS | VII.1 |
| | A. Introduction | VII.1 |
| | B. Conventional Transit Experience | VII.2 |
| | C. Paratransit Experience | VII.67 |

LIST OF TABLES


| Table | | Page |
|---|---|---|
| III-1 | Inventory of Population Characteristics | III.17 |
| III-2 | Inventory of Land Use Characteristics | III.18 |
| III-3 | Inventory of Existing Transit Services | III.19 |
| III-4 | Inventory of Relevant Institutional Factors | III.21 |
| III-5 | Inventory of Other Relevant Characteristics | III.22 |
| III-6 | Transit Survey Techniques | III.24 |
| III-7 | Typical Small Urban Community Transit Markets | III.28 |
| IV-1 | Brief Description of the Elements of a Transit System | IV.3 |
| IV-2 | Typical Characteristics of Seven Common Forms of Transit Service | IV.7 |
| IV-3 | Shared-Ride Taxi Services--Selected Examples | IV.20 |
| IV-4 | Dial-a-Ride Transit Services--Selected Examples | IV.22 |
| IV-5 | Van Pool Transit Services--Selected Examples | IV.30 |
| IV-6 | Bus Pool Programs--Selected Examples | IV.35 |
| IV-7 | Environments Suitable for the Implementation of Seven Basic Transit Alternatives Appropriate for Consideration in Small Urban Communities | IV.44 |
| V-1 | Analytical Characteristics of Demand Estimation Methods | V.12 |
| V-2 | Implementation Characteristics of Demand Estimation Methods | V.17 |
| V-3 | Transit Demand Estimation Example Using Transit Ridership Propensity Curves | V.32 |

LIST OF TABLES (CONT.)


| Table | | Page |
|---|---|---|
| V-4 | Systemwide Ridership - Fixed-Route, Fixed-Schedule Transit Service: Application Example | V.42 |
| V-5 | Procedures to Determine the Size of 17 Typical Transit Markets in Small Urban Communities | V.70 |
| V-6 | Estimated Tripmaking Rates for Elderly Persons | V.85 |
| V-7 | Estimated Tripmaking Rates by Income Stratification | V.86 |
| V-8 | Distribution of Transportation Handicapped Respondents and Estimated Number of Transportation Handicapped Persons in Urban Population by Sex, Age, and Family Income | V.87 |
| V-9 | Frequency of Travel of Transportation Handicapped Persons | V.88 |
| V-10 | Current Transit Vehicle Prices | V.107 |
| V-11 | Recent Transit Facility Costs | V.108 |
| V-12 | Estimated Future DRT Operating Expense Per Vehicle-Hour Operated | V.124 |
| V-13 | Allocation of Transit Operating Expenses to Two Causal Factors: Vehicle-Miles Operated and Vehicle-Hours Operated | V.134 |
| V-14 | Allocation of Transit Operating Expenses to Four Causal Factors: Vehicle-Miles Operated, Vehicle-Hours Operated, Number of Vehicles in Service, and Number of Vehicle Operators | V.138 |
| V-15 | Summary of Federal Legislation in Support of Transit Development and Operation | V.143 |
| V-16 | Outline of Federal Planning Requirements | V.145 |

LIST OF TABLES (CONT.)


| Table | | Page |
|---|---|---|
| V-17 | State Capital Cost Subsidy Programs for Small Urban Communities | V.152 |
| V-18 | State Operating Expense Subsidy Programs for Small Urban Communities | V.153 |
| V-19 | Alternative Financing Mechanisms of Various Administrative Entities | V.155 |
| V-20 | Local Tax Sources Specifically Authorized for Transit Support | V.157 |
| VI-1 | Advantages and Disadvantages Associated with Varying Degrees of External Organizational Control | VI.5 |
| VI-2 | Transit Organization Staffing Requirements | VI.18 |
| VI-3 | Qualifications for Evaluation of Managerial Candidates | VI.20 |
| VII-1 | Conventional Bus Transit Profile (1970-1973) | VII.4 |
| VII-2 | Definition of Variables and Statistics | VII.5 |
| VII-3 | Conventional Bus Transit Profile (1974) | VII.15 |
| VII-4 | Description of Conventional Bus Transit Systems | VII.24 |
| VII-5 | Demographic Cross Section of Small Urban Area Transit Riders | VII.26 |
| VII-6 | Summary of Conventional Bus Transit Captive Ridership Indicators | VII.27 |
| VII-7 | Transit Ridership Characteristics | VII.28 |
| VII-8 | NTS Figures | VII.40 |

LIST OF TABLES (CONT.)


| Table | | Page |
|---|---|---|
| VII-9 | Description of Selected Shared-Ride Demand-Responsive Transportation Services | VII.71 |
| VII-10 | Supply Statistics for Selected Shared-Ride Demand-Responsive Transportation Services | VII. 75 |
| VII-11 | Demand Statistics for Selected Shared-Ride Demand-Responsive Transportation Services | VII. 79 |
| VII-12 | Cost and Revenue Statistics for Selected Shared-Ride Demand-Responsive Transportation Services | VII. 83 |
| VII-13 | Characteristics of Selected Van Pool Programs | VII. 95 |
| VII-14 | Characteristics of Selected Bus Pools, Commuter Bus Clubs, and Subscription Bus Services | VII. 97 |

# LIST OF FIGURES


| Figure | | Page |
|---|---|---|
| II-1 | Process for Planning Conventional Transit and Paratransit Alternatives in Small Urban Communities | II.3 |
| III-1 | Relation Between Goals, Objectives, Criteria, and Standards | III.3 |
| III-2 | Hierarchy of Goals and Objectives in the Small Urban Community | III.5 |
| III-3 | Generation of Transit Service Objectives | III.13 |
| V-1 | Cost Effectiveness Graph | V.4 |
| V-2 | Cost Effectiveness Example | V.7 |
| V-3 | Demand Analysis Methods | V.11 |
| V-4 | Transit Ridership Propensity Curves | V.28 |
| V-5 | Direct Demand Estimation for Fixed-Route, Fixed-Schedule Transit Service/Base Annual Ridership/ Method A | V.35 |
| V-6 | Direct Demand Estimation for Fixed-Route, Fixed-Schedule Transit Service/Base Annual Ridership/ Method B | V.36 |
| V-7 | Direct Demand Estimation for Fixed-Route, Fixed-Schedule Transit Service/One-Way Loop Factor | V.39 |
| V-8 | Direct Demand Estimation for Fixed-Route, Fixed-Schedule Transit Service | V.40 |
| V-9 | Average Daily Ridership Versus Total Fleet Size/ 1,000 Persons Served/DRT and Shared-Ride Taxi Service/No Competing Local Transit Service | V.47 |

LIST OF FIGURES (CONT.)


| Figure | | Page |
|---|---|---|
| V-10 | Average Daily Ridership Versus Total Fleet Size/ Square Mile of Service Area/DRT and Shared-Ride Taxi Service/No Competing Local Transit Service | V.48 |
| V-11 | Average Daily and Hourly Ridership Versus Daily Vehicle-Hours of Service/DRT and Shared-Ride Taxi Service/No Competing Local Transit Service | V.49 |
| V-12 | Average Daily Ridership Versus Total Fleet Size/ 1,000 Persons Served/DRT and Shared-Ride Taxi Service/Competing Local Public Transit Service | V.50 |
| V-13 | Average Daily Ridership Versus Total Fleet Size/ Square Mile of Service Area/DRT and Shared-Ride Taxi Service/Competing Local Public Transit Service | V.51 |
| V-14 | Average Daily Ridership Versus Total Fleet Size/ 1,000 Eligible Elderly and Handicapped Users/ DRT Exclusively for the Elderly and Handicapped | V.53 |
| V-15 | Average Daily Ridership Versus Total Fleet Size/ Square Mile of Service Area/DRT Service Exclusively for the Elderly and Handicapped | V.54 |
| V-16 | Average Daily Ridership Versus Total Fleet Size/ 1,000 Persons Served/DRT Service Coordinated with Local and Regional Public Transit | V.56 |
| V-17 | Average Daily Ridership Versus Total Fleet Size/ Square Mile of Service Area/DRT Service Coordinated with Local and Regional Public Transit | V.57 |
| V-18 | Average Daily and Hourly Ridership Versus Daily Vehicle-Hours of Service/DRT Service Coordinated with Local and Regional Public Transit | V.58 |
| V-19 | Estimated DRT Ridership Frequency - Age Group 16-24 Years | V.61 |

LIST OF FIGURES (CONT.)


| Figure | | Page |
|---|---|---|
| V-20 | Estimated DRT Ridership Frequency - Age Group 25-54 Years | V.62 |
| V-21 | Estimated DRT Ridership Frequency - Age Group 55+ Years | V.63 |
| V-22 | Ability of the Transportation Handicapped to use Transportation Services | V.89 |
| V-23 | Aggregate Work Trip Modal Split Model 1 - Modal Share as a Function of Automobile Availability | V.91 |
| V-24 | Aggregate Work Trip Modal Split Model 2 - Modal Share as a Function of Annual Family Income | V.92 |
| V-25 | Walk Mode Split as a Function of Distance to Work | V.95 |
| V-26 | Wholesale Price Index of Motor Vehicles and Equipment - 1964-1974 | V.111 |
| V-27 | Cost Multipliers for Planned Investment in Transit Vehicles and Equipment | V.112 |
| V-28 | Department of Commerce Composite Construction Cost Index - 1964-1975 | V.113 |
| V-29 | Cumulative Frequency Distribution of Selected Conventional Transit Unit Operating Expenses | V.118 |
| V-30 | Index of Local Transit Wage Rates - 1960-1973 | V.120 |
| V-31 | Cumulative Frequency Distribution of Selected DRT Unit Operating Expenses | V.122 |
| V-32 | Conventional Transit Annual Operating Expense Versus Vehicle-Hours Operated (Top Operator's Wage Rate) | V.126 |

LIST OF FIGURES (CONT.)


| Figure | | Page |
|---|---|---|
| V-33 | Conventional Transit Annual Operating Expense Versus (Vehicle-Hours Operated) (Top Operator's Wage Rate) and (Vehicles-in-the-Peak Service Schedule) | V.128 |
| V-34 | Average Daily Operating Expense Versus Average Daily Vehicle-Hours Operated in Areawide Many-to-Many DRT (or Shared-Ride Taxi Service) with no Other Local Competing Transit Service Available | V.129 |
| V-35 | Average Daily Operating Cost Per Passenger Versus Average Daily Ridership in Many-to-Many DRT and Shared-Ride Taxi/Competing Local Transit Service Available | V.130 |
| V-36 | Average Daily Operating Expense Versus Average Daily Ridership in Many-to-Many DRT and Shared-Ride Taxi/Competing Local Public Transit Service Available | V.131 |
| V-37 | Average Daily Operating Expense Versus Average Daily Vehicle-Hours | V.132 |
| V-38 | DRT Operating Expense Estimation | V.133 |
| VI-1-a | Basic Internal Structure for Small Transit Organizations | VI.16 |
| VI-1-b | First Variation on Internal Structure for Small Transit Organizations | VI.16 |
| VI-1-c | Second Variation on Internal Structure for Small Transit Organizations | VI.16 |
| VI-2-a | Basic Internal Structure for Medium-Sized Transit Organizations | VI.17 |
| VI-2-b | Variation on Internal Structure for Medium-Sized Transit Organizations | VI.17 |

LIST OF FIGURES (CONT.)


| Figure | | Page |
|---|---|---|
| VII-1 | Annual Bus-Miles Operated Per Person Served Versus Service Area Population (1970) | VII. 8 |
| VII-2 | Frequency Distribution of Annual Passengers Per Bus-Mile for 20 Conventional Bus Transit Firms Reporting to APTA (1970-1973) | VII. 9 |
| VII-3 | Frequency Distribution of Bus Transit Operating Ratios for 20 Conventional Bus Transit Firms Reporting to APTA (1970-1973) | VII. 11 |
| VII-4 | Frequency Distribution of Peak to Base Ratios for 20 Conventional Bus Transit Firms Reporting to APTA (1970-1973) | VII. 13 |
| VII-5 | Frequency Distribution of Employees Per Peak Bus for 20 Conventional Bus Transit Firms Reporting to APTA (1970-1973) | VII. 14 |
| VII-6 | Cumulative Frequency Distribution of Annual Bus-Miles Operated Per Person Served for 30 Conventional Bus Transit Firms Reporting to APTA (1974) | VII. 17 |
| VII-7 | Cumulative Frequency Distribution of Selected Service Supply Statistics for 30 Conventional Bus Transit Firms Reporting to APTA (1974) | VII. 18 |
| VII-8 | Cumulative Frequency Distribution of Passengers per Bus-Mile for 30 Conventional Bus Transit Firms Reporting to APTA (1974) | VII. 19 |
| VII-9 | Cumulative Frequency Distribution of Selected Revenue/Expense Characteristics for 30 Conventional Bus Transit Firms Reporting to APTA (1974) | VII. 20 |
| VII-10 | Cumulative Frequency Distribution of Selected System Design Characteristics for 30 Conventional Bus Transit Firms Reporting to APTA (1974) | VII. 21 |

LIST OF FIGURES (CONT.)


| Figure | | Page |
|---|---|---|
| VII-11 | Bus Ridership by Time of Day in Selected Small Urban Areas (30,000 to 100,000 Population) | VII. 31 |
| VII-12 | Bus Ridership by Time of Day for Selected Medium-Sized Urban Areas (100,000 to 400,000 Population) | VII. 32 |
| VII-13 | Bus Ridership by Day of Week | VII. 34 |
| VII-14 | Transit Trip Purpose by Time Period--Portland, Maine | VII. 35 |
| VII-15 | Bus Fleet Size Versus Urbanized Area Population | VII. 42 |
| VII-16 | Transit Supply Versus Urbanized Area Population | VII. 43 |
| VII-17 | Transit Service Coverage Versus Urbanized Area Population | VII. 45 |
| VII-18 | Frequency Distribution of Revenue Bus-Miles Per Person Served | VII. 47 |
| VII-19 | Frequency Distribution of Average Operating Speed (Weekday) | VII. 48 |
| VII-20 | Annual Transit Ridership Versus Urbanized Area Population | VII. 49 |
| VII-21 | Weekday Transit Ridership Versus Urbanized Area Population | VII. 50 |
| VII-22 | Frequency Distribution of Passengers Per Person Served (Annual) | VII. 51 |
| VII-23 | Frequency Distribution of Percent of Passengers Who Transfer | VII. 52 |
| VII-24 | Frequency Distribution of Passengers Per Revenue Bus-Mile (Annual) | VII. 54 |

LIST OF FIGURES (CONT.)


| Figure | | Page |
|---|---|---|
| VII-25 | Transit Supply Versus Annual Transit Ridership--Small Urbanized Areas (50,000-250,000 Population) | VII. 55 |
| VII-26 | Transit Supply Versus Annual Transit Ridership--Medium-Sized Urbanized Areas (250,000-500,000 Population) | VII. 57 |
| VII-27 | Transit Supply Rate Versus Transit Demand Rate | VII. 58 |
| VII-28 | Frequency Distribution of Operating Revenue Per Passenger (Average Fare) | VII. 59 |
| VII-29 | Annual Operating Revenue Versus Annual Transit Ridership--Small Urbanized Areas (50,000-250,000 Population) | VII. 60 |
| VII-30 | Annual Operating Revenue Versus Annual Transit Ridership--Medium-Sized Urban Areas (250,000-500,000 Population) | VII. 61 |
| VII-31 | Frequency Distribution of Operating Expense Per Revenue Bus-Mile | VII. 62 |
| VII-32 | Annual Operating Expense Versus Transit Supply--Small Urbanized Areas (50,000-250,000 Population) | VII. 63 |
| VII-33 | Annual Operating Expense Versus Transit Supply--Medium-Sized Urbanized Areas (250,000-500,000 Population) | VII. 64 |
| VII-34 | Annual Operating Revenue Versus Annual Operating Expense--Small Urbanized Areas (50,000-250,000 Population) | VII. 65 |
| VII-35 | Annual Operating Revenue Versus Annual Operating Expense--Medium-Sized Urbanized Areas (250,000-500,000 Population) | VII.66 |

# Chapter I

# INTRODUCTION

This manual provides information and techniques designed to help plan for new or improved transit services in small urban communities that are currently sponsoring, promoting, providing, or simply considering such services. It is intended to be used principally by planners and decision-makers in small urban communities with less than 200,000 residents but many portions would be useful in larger urban areas as well.

The manual presents analytical techniques to assist in planning for both conventional bus transit and paratransit alternatives. Specifically, techniques for identifying conventional transit and paratransit service opportunities and for estimating the demand, cost, and revenue implications of various transit service alternatives are presented. In addition, opportunities for federal and state financial assistance are summarized, federal planning requirements are described, and the experience of many other urban communities currently sponsoring, promoting, or providing local mass transportation services is illustrated. The information and analytical techniques presented in this manual are contained in the following three volumes:

- Volume One - TRANSIT SERVICE OBJECTIVES AND OPTIONS:
    - Chapter I - Introduction
    - Chapter II - A Procedure for Planning Conventional Transit and Paratransit Service in Small Urban Communities
    - Chapter III - Identifying Objectives for Transit Services
    - Chapter IV - Formulating Transit Service Opportunities
- Volume Two - ANALYSIS METHODS:
    - Chapter V - Evaluating Transit Service Alternatives
- Volume Three - SUMMARY OF MANAGEMENT AND OPERATIONS EXPERIENCE:
    - Chapter VI - Planning for Transit Management and Operation

- Chapter VII - Transit Experience in Other Urban Communities

Chapter I, "Introduction," defines the applicability and describes the structure and content of the manual.

Chapter II, "A Procedure for Planning Conventional Transit and Paratransit Service in Small Urban Communities," presents a generalized process for planning conventional transit and paratransit alternatives in small urban communities. The process includes three basic set of activities:

(1) identifying objectives for local transit services;

(2) formulating transit service opportunities; and

(3) evaluating transit service alternatives.

Chapter III, "Identifying Objectives for Local Transit Services," presents information to assist in the first set of activities in the planning process. The relation between goals, objectives, standards, and criteria is defined, the importance of transit service objectives is discussed, and guidelines for establishing local transit goals and objectives and for assessing the local need for transit service are given.

Chapter IV, "Formulating Transit Service Opportunities," presents information to assist in the second set of activities in the planning process. The range of characteristics that differentiate between transit service alternatives is described. In addition, the capabilities of specific modal opportunities are summarized, and their relation to the achievement of local transit service objectives is discussed.

Chapter V, "Evaluating Transit Service Alternatives," presents information and techniques designed to assist in the third set of activities in the planning process. A procedure for evaluating transit service alternatives is described, and techniques to assist in the evaluation are given. Specifically, techniques are presented to assist with estimation of the patronage, cost, and revenue implications of transit service alternatives.

Chapter VI, "Planning for Transit Management and Operation," discusses the activities of a transit operation, explores the relations between these activities, identifies arguments for and against local control of transit organizations, provides estimates of staff requirements for various-sized transit systems, and describes the desired characteristics of a transit manager.

Chapter VII, "Transit Experience in Other Urban Communities," serves as a source of reference information. Data and statistics are given on the financial and operating performance of existing conventional transit and paratransit services in small urban communities. This information is available for the quick evaluation of transit service alternatives in comparable small urban communities.

Chapter II

# A PROCEDURE FOR PLANNING CONVENTIONAL TRANSIT AND PARATRANSIT SERVICE IN SMALL URBAN COMMUNITIES

## A. Introduction

Transit planning in small urban communities is done either (1) because no transit service is available and the small urban community would like to consider the initiation of transit service or (2) because transit service is available but the small urban community would like to consider replacement or modification of or addition to existing transit service. In either case, careful planning for transit services is essential so that local planners and decisionmakers can answer the following questions:

- Is there a need for (more, different) transit service in the community?
- What should the objectives of transit service be in the community?
- What are the opportunities for transit service in the community?
- What are the capabilities of different transit alternatives?
- How many people in the community would use transit service?
- How much will transit service cost the community?
- How should the community finance the expense of providing transit service?
- What role should the community play in the management and operation of transit service?

In this chapter, a systematic process to aid small urban communities in answering these questions when planning for conventional transit and paratransit services is described.

## B. The Nature of the Transit Planning Process

The transit planning process in small urban communities consists of a simple and logical sequence of steps. These steps combine to form the following basic tasks:

1. Identify objectives for local transit service.

2. Formulate transit service opportunities.

3. Perform preliminary evaluation of transit service opportunities.

4. Select transit service alternatives for detailed evaluation, or reassess local transit service standards and objectives.

5. Perform detailed evaluation of transit service alternatives.

6. Select transit service alternative(s) for implementation, or decide not to implement transit service.

7. Prepare final design and strategy for implementing selected transit service alternative(s).

As shown in Figure II-1, transit planning involves three phases: the feasibility analysis phase, the detailed evaluation phase, and the implementation phase. Each of these phases is described below, and sections of this manual that have been prepared to assist small urban communities in performing specific tasks in these phases are identified.

Throughout the transit planning process, citizen participation should be encouraged and every effort should be made to facilitate citizen involvement in the planning for transit services. Citizen involvement in the process is, in fact, mandatory if federal financial assistance is being sought for capital investment in transit facilities and equipment.[1] Selected references for consideration in the development and implementation of the citizen involvement process are provided below.

---

[1]Citizen involvement is mandated by the joint planning regulations issued by Federal Highway Administration and Urban Mass Transportation Administration as set forth in the Federal Register of September 17, 1975, Title 23 of the Code of Federal Regulations, Section 450.120(a)(3), joint regulations for the urban transportation planning process: "The urban transportation planning process shall... include provisions to ensure involvement of the public."

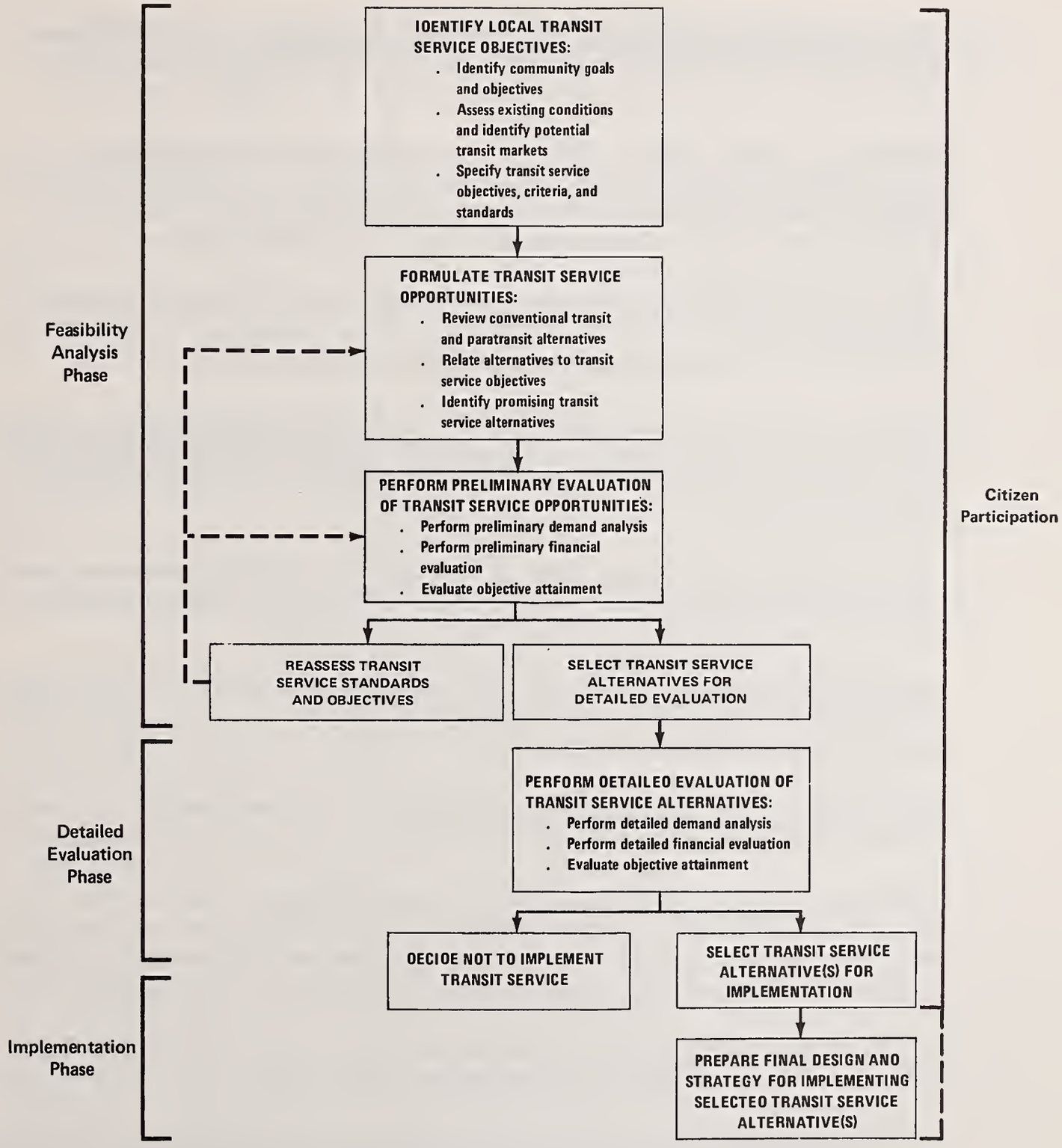


FIGURE II-1: PROCESS FOR PLANNING CONVENTIONAL TRANSIT AND PARATRANSIT ALTERNATIVES IN SMALL URBAN COMMUNITIES

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1. Feasibility Analysis Phase

In this phase of the transit planning process, major emphasis is placed on the identification of objectives for local transit services and the formulation of transit service opportunities. The evaluation of transit service alternatives is conducted at a gross level of detail.

a. Formulation of Transit Service Objectives

The first task in the planning process is to identify community goals and objectives and to define the desired role of conventional transit or paratransit service within the community. In Section III.B of this manual, the relation between goals, objectives, standards, and criteria is defined, the importance of specifying transit service objectives is discussed, and guidelines to assist local planners and decisionmakers in developing community goals and objectives for transit service are presented.

After the overall community goals and objectives have been identified, it is necessary to inventory the nature of existing transportation and transportation-related conditions in the community to determine the specific objectives for transit service. The inventory includes a detailed description of existing transit services and the identification of potential transit markets. The type, usefulness, and sources of data needed to complete this inventory are described in Section III.C of this manual, as are the procedures for obtaining the data.

The inventory of existing conditions, together with the statement of community goals and objectives, provides for the explicit definition of the local need for transit service implementation or improvement and forms the basis for determining the extent of the local commitment to provide, promote, or sponsor transit service. Those communities with no existing transit service or minimal public involvement in the provision of local transit service will need to gain a practical perspective at this stage in the planning process by reviewing the experience of other small urban communities in sponsoring, promoting, or providing such service. A summary of this experience is contained in Chapter VII of this manual.

b. Identification of Transit Service Alternatives

Once the need for and objectives of local transit service implementation or improvement have been established, specific alternative opportunities for providing that service should be formulated. No single transit service is likely to meet every transportation need in a community. If the characteristics of a particular service do not match the requirements of a sufficient number of people, the service will not attract riders and will therefore not realize all of its objectives.

In the first phase of the planning process, therefore, a wide range of alternative service concepts should be considered; particular attention should be directed to determining what the implications of various options are, both for potential transit markets and for specific transit service objectives. A review and assessment of the range of conventional transit or paratransit alternatives available for achieving desired objectives will permit the small urban community to identify a set of promising alternatives for further consideration. In Chapter IV of this manual, transit service characteristics are described, a general description of basic service options is presented, the capabilities of basic service options are discussed in relation to transit service objectives and examples of individual service alternatives are summarized.

To complete the identification of the alternatives, a description of each transit service alternative must be prepared for evaluation. At this point, very detailed descriptions of transit service alternatives are not necessary; no precise rules for describing the process of defining the range of transit service alternatives can be set forth. However, in small urban communities, the set of alternatives is in fact limited. For example, network systems are typically limited to those roads that can accommodate conventional bus vehicles. Of such roads, the ones on which service should be provided link as much residential concentration with high-density employment and commercial development as possible. In practice, local planners and decisionmakers should use their experience and special knowledge of the community to specify transit service alternatives.

c. Evaluation of Transit Service Alternatives

The final task in the feasibility analysis phase involves the evaluation of transit service alternatives. In this task, estimates of the patronage, cost, and revenue implications of alternative actions are made, and an assessment of each alternative's potential for meeting local transit objectives is conducted. Techniques for measuring

these implications are presented in Chapter V of this manual. The results of this task provide the data and information necessary to make rational decisions regarding alternative actions.

The preliminary estimates of the demand for different transit alternatives, the financing requirements of each alternative, and the degree to which these alternatives satisfy community objectives for transit service are used for two purposes: (1) to determine the reasonability of the objectives the small urban community has set for transit service and (2) to reduce the number of alternatives to be evaluated in the second phase of the planning process. In short, the small urban community has to reconcile the objectives it has set for transit service with the cost implications and capabilities of various transit alternatives for achieving those objectives. If the community's objectives are not met by any of the alternatives analyzed, or if they are met at too high a cost to the community, either they should be reassessed or the community should reconsider its financial commitment to transit. On the other hand, if a number of alternatives satisfy community objectives at a reasonable cost, they should be evaluated further.

Typically, most alternatives will satisfy some objectives well and other objectives poorly or not at all. The small community planner and decisionmaker must therefore weigh the value of alternative transit objectives to determine the desirability of considering various alternatives further. When weights are assigned to different transit objectives, each alternative can be ranked according to how well it achieves the community's overall objectives for transit service.

2. Detailed Evaluation Phase

In the detailed evaluation phase of the planning process, more emphasis is placed on the description and evaluation of the remaining alternatives.

The first task in this phase is to describe the set of remaining transit alternatives in finer detail than they were described in the feasibility analysis phase. For conventional bus transit alternatives, the location and number of routes, the number and type of buses, the level of service (hours of operation, frequency of service, etc.), and the fare level and structure should be specified. For dial-a-ride service, alternative service areas should be identified, and the number and type of vehicles, the type of service (many-to-many, many-to-one, etc.), and the fare level and structure should be specified. For subscription type services (van pools, charter bus operations, etc.) major origins

and destinations should be identified (together with trip purposes), and the number and type of vehicles, the type of service, and the fare level and structure should be specified. Again, local planners and decisionmakers should use their experience and special knowledge of the community in specifying these transit service alternatives.

After the transit service alternatives have been described, the patronage, cost, and revenue implications of each alternative are estimated. Also, a detailed assessment of each alternative's potential for achieving local transit objectives is conducted. The results of these analyses are used to determine the transit service alternative(s) to be implemented in the small urban community. As before, the small community planner and decisionmaker conduct the following steps toward determining which transit alternatives (if any) should be implemented:

- Weigh transit service objectives.
- Assess each alternative's achievement of specific transit service objectives.
- Determine each alternative's achievement of overall transit service objectives.
- Measure the achievement of overall transit service objectives in relation to the cost to the community.
- Rank the transit service alternatives.
- Select the transit service alternative(s) for implementation.

3. Implementation Phase

In the final phase of the transit planning process, the transit service alternative(s) selected for implementation are designed in sufficient detail for their subsequent implementation. Specific routes or service areas are identified; the fare level and structure are specified; vehicle, labor, facility, and equipment requirements are determined; management and operating organizations are selected; information and promotional campaigns are formulated; and the financing program is detailed.

Chapter III

# IDENTIFYING OBJECTIVES FOR LOCAL TRANSIT SERVICES

## A. Introduction

The general purpose of any transit service is to satisfy certain needs or solve certain problems as economically as possible. The first step in a systematic effort to solve problems or satisfy unfulfilled needs is to clearly specify the objectives.

Clearly stated objectives are of paramount importance for local conventional transit and paratransit services. If the objectives of a transit service are unspecified, its performance cannot be evaluated fully, and the need for the service can always be questioned.

In this chapter, guidelines for specifying objectives, criteria, and standards for transit services are presented (Section III. B). In addition, a framework is described for conducting an analysis of existing conditions to determine specific needs and problems that present local opportunities for transit service implementation or expansion (Section III. C).

## B. Goals, Objectives, Standards, and Criteria

Clear, precise statements of objectives are essential for designing and evaluating conventional transit and paratransit services. Without these statements of objectives, neither the performance nor the capabilities of a transit service can be evaluated meaningfully.

The number and wording of objectives influence the number and kinds of alternative solutions considered. Imprecise objectives, an incomplete set of objectives, or the lack of stated objectives can induce a bias toward one particular form of transit and exclude alternatives from consideration. Examples of this bias can be found in many transit studies in which only one type of transit service is considered and recommendations are made without any statement of precisely what the service should accomplish.

In many such studies, the capabilities of the chosen type of transit service are not fully assessed, and other services more suitable for certain needs are not seriously considered. A comprehensive set of objectives, therefore, is important not only for evaluating the performance and justifying the existence of a particular transit service but also for broadening the perspective of planners and policymakers to include many possible alternatives.

1. Definition of Terms

Closely related to objectives and equally important are goals, criteria, and standards. The relation between these terms is illustrated in Figure III-1.

Goals are idealized ends or aims toward which individuals, businesses, organizations, and communities strive. An example of a transportation-related goal is to enable people and goods to move safely, efficiently, and economically within the community. Since, like all goals, this one is vague and general, it can never be fully achieved, and there are no simple measures for determining how well it is being achieved. Although it is useful as a concise expression of community values and for prescribing various approaches to fulfilling these values, to be useful for evaluative purposes, it must be related to a set of specific objectives.

As Figure III-1 shows, objectives proceed from goals. They are more specific statements of the desired results of projects, services, or other efforts designed to reach a goal. The wording of an objective is specific enough to suggest appropriate measures of how well it can be or is being achieved by a given alternative. An example of an objective designed to meet the goal of ensuring the social and physical welfare of the community's residents is to provide handicapped people with access to health and medical services in the community. Two alternative ways of accomplishing this objective are to (1) transport these people to the services or (2) bring the services to the people. Had the objective been to provide handicapped people with a means of transportation to health services, the latter alternative probably would not have been considered. This shows how the wording of an objective can affect the generation of ideas for solving a problem.

Criteria are the rules, tests, or measures used to determine how well the objectives can be or are being achieved. They indicate how effective an alternative is in attaining one or more objectives. Ideally, the criteria should directly measure the level of attainment; unfortunately, however, many important objectives, such as those concerning aesthetics, are difficult to quantify, and approximate measures of effectiveness must be used to determine their attainment. Two possible criteria for the objective in the above example are the number of handicapped people served and the number of health services that are made accessible.

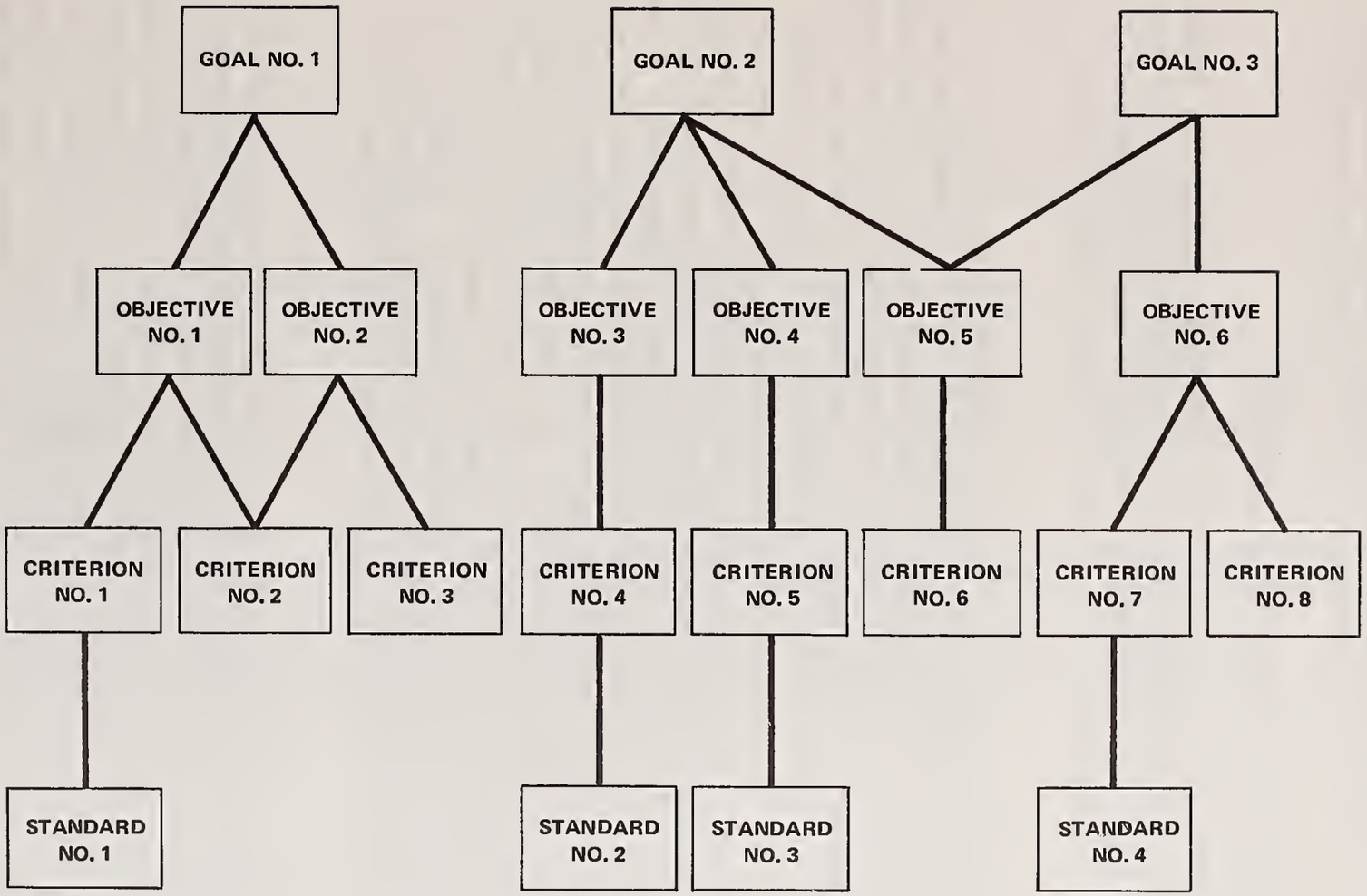


FIGURE III-1: RELATION BETWEEN GOALS, OBJECTIVES, CRITERIA, AND STANDARDS

A standard is a special type of criterion. It is that value of a criterion or level of attainment above or below which an alternative is acceptable. When standards can be applied, they can greatly simplify the tasks of evaluating alternatives and reaching a decision.

2. The Hierarchy of Goals and Objectives

Although this manual is primarily concerned with goals, objectives, criteria, and standards for specific transit services, the fact that a hierarchy of goals and objectives exists in a small urban community must also be pointed out. This hierarchy is illustrated in Figure III-2.

At the highest level are the goals of the community (the categories of community goals shown in Figure III-2 are illustrative only). Despite the difficulty of identifying a community's goals, a structured set of them is valuable as a guide for reaching public decisions. Elected and appointed public officials must make decisions on the use of public resources for numerous programs, projects, and services to meet certain public needs. Presumably, each program, project, or service has a purpose related to certain goals of the community, but often after a period of years the original intent may be forgotten and the programs, projects, and services may become self-perpetuating. A carefully articulated set of community goals can help to alleviate this situation and provide a basis for justifying either the continuation or the termination of a program. A concerted effort to formalize the community's goals can make planners and public officials more aware of the distinction between a desired end--the goal--and the means for striving toward it--the program, project, or service. Once goals have been established, public officials can organize programs, projects, and services and budget the community's limited resources around them.

The second level in the hierarchy consists of the goals and objectives of the various urban systems that make up the community. Each of these systems is made up of people, institutions, organizations, facilities, equipment, processes, procedures, activities, rules, and regulations that interact in a complex manner for a common purpose or purposes. Because of the complexity of these systems, conflicts inevitably arise within and between them. The challenge facing urban planners is to determine the goals and objectives of each urban system with those people, institutions, or agencies responsible for managing or controlling it and to direct the functions of each system toward the achievement of the community's goals through the development of comprehensive plans.

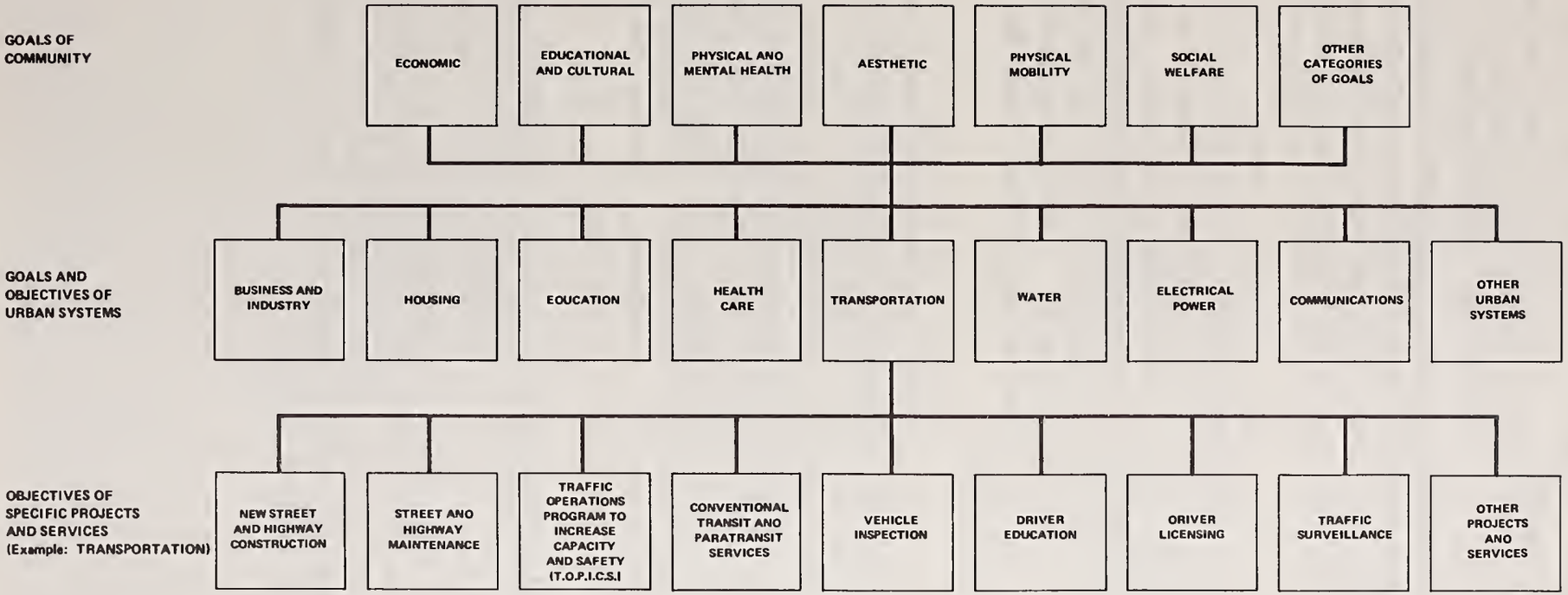


FIGURE III-2: HIERARCHY OF GOALS AND OBJECTIVES IN THE SMALL URBAN COMMUNITY

The importance of relating each urban system's goals and objectives to the goals of the community can be easily seen by considering the transportation system. The local transportation system, consisting of all of the people, facilities, vehicles, and other elements involved in the movement of people and goods, interacts in a very complicated manner with other urban systems. Transportation facilities and services impact air pollution; noise; supply and consumption of fuel; location, timing, and scale of land development; property values; and neighborhood solidarity. The performance of the transportation system is alternately affected by changes in other urban systems, such as the relocation of old businesses and the development of new ones; the development of new, high-density residential areas; and technological advances in communications. Transportation facilities and services also compete with the other urban systems for land, energy, materials, capital, labor, and other resources. Because of the intricate relation between transportation and other elements of the city, the local transportation system is an important means of achieving many of the community's goals. In fact, the goals of the transportation system and any other urban system should be a subset of the goals of the community.

Before alternative transportation plans can be developed and evaluated, therefore, specific objectives must be derived from the goals of the transportation system. These objectives can be divided into two categories: those concerning the system's performance (ability to move people and goods) and those concerning the system's concomitant effects (by-products), such as air pollution, energy consumption, and disruption of neighborhoods. As planners learn more about the operation of the transportation system and as controversy over certain transportation projects continues to arise, the list of objectives for a transportation system grows longer.

At the third level of the hierarchy are the objectives of specific projects and services undertaken or provided by either the public or the private sector. Each project or service should be designed to meet certain chosen objectives of the urban system to which it is associated. For example, the objectives of the transportation system are achieved through the combination of many projects, facilities, and services and not through the construction of one type of highway or the provision of one type of transit service.

### 3. Guidelines for Specifying Objectives, Criteria and Standards for Transit Services

The importance of objectives in planning and operating conventional transit and paratransit services was indicated at the beginning of this chapter. If the objectives of a transit service are unspecified, its performance cannot be fully evaluated, and the need for it can always be questioned.

The question is what should the objectives of a transit service be. Presumably, the general purpose of any transit service is to satisfy certain needs or solve certain problems as economically as possible with minimal adverse side effects. The objectives of any particular transit service should therefore cover:

- the needs to be satisfied or problems to be solved;
- the economics of the service; and
- the side effects to be avoided or minimized.

Specific objectives cannot be prescribed in this manual, since they can be specified only after all aspects of the particular local problem are studied and understood. However, several points should be considered in specifying these objectives and the criteria for measuring their attainment.

#### a. The objectives must be precise.

An objective such as "improve public transportation" is too general for any meaningful evaluation.

#### b. The objectives must be measurable but do not have to be quantifiable.

The statement of an objective should at least imply the criteria for measuring achievement of the objective. For example, the criteria for the objective of enhancing the image of the downtown area are not readily apparent. The image of a downtown area can be measured indirectly in many ways, such as by an increase in the number of downtown shoppers, an increase in retail sales, a reduction in the vacancy rate of retail and office space, and a reduction in the number of auto accidents involving pedestrians. The objective to "improve public transportation" would be more meaningful if its wording reflected these possible criteria.

The requirement that an objective be measurable does not mean that the criteria used for evaluation must be numerical. For the objective of avoiding the need to impose an additional local tax, the criterion would simply be whether or not the tax was indeed avoided. If the chosen transit service does operate without an additional tax to finance it, it has accomplished the objective. A better objective, however, would be to minimize the deficit, minimize the ratio of operating costs to operating revenues, or break even. The criterion in each case would be numerical.

c. Objectives must not be tied to a specific transit service.

Statements such as "provide bus service," "provide more buses," or "provide at least one bus stop every 6 blocks" are inappropriate as objectives because they actually represent alternatives. Such statements imply that a bus service or any other transit service is a desirable end in itself. Posed as objectives, they block other possible alternatives from consideration. The objectives should reflect the problem to be solved, the desired consequences or level of performance of any solution to the problem, and the undesirable side effects to be minimized or avoided. An objective, by definition, is an end and not a means.

d. The most important objective of any transit service should be to attract as many riders as possible from its intended market.

Whether it is regarded as a business or an essential public service, a transit system must generate a demand for or attract customers to its service. It may very well reduce traffic congestion and auto pollution, improve the mobility of people who do not have an automobile, revitalize the downtown area, and meet other societal objectives, but only to the extent that it can attract riders from its intended market. An evaluation based solely on travel time, wait time, headways, comfort, safety, reliability, and other standards of service can be misleading if the service does not penetrate its market to a significant degree. To be useful or successful, a transit service does not have to be able to convey every type of individual in the community. Businessmen, who understand and apply the principles of marketing, know that products and services that attempt to be all things to all people often do not satisfy the needs of anyone very well. Many of the efforts to improve public transportation have been preoccupied with the existing service rather than with the needs of a specific group of people or market segment and consequently have simply attempted to sell a service that is unrelated to the needs of a large number of people. The objective should specify the number and groups of people to be served so that attention can be focused on their particular capabilities and needs.

e. The statement of an objective should indicate or at least imply how the transit service can help achieve the objective.

There must be a causal relationship between the provision of a transit service and the achievement of the objective. Otherwise, the ability of a transit service to fulfill certain objectives not directly related to transportation can be exaggerated. For example, public transportation has been proposed as a means of promoting economic growth, shaping the development of land, and maintaining or improving the viability of the downtown area. Such statements are meaningless as objectives unless they can be phrased in quantifiable terms that relate the provision of a transit service to the achievement of these ends.

To help in determining how close the relationship between providing a transit service and achieving an objective is, the objective should be classified as either intermediate or ultimate. An intermediate objective is one that must be achieved at least partially before the ultimate objective can be reached. Increasing the number of places of employment that are accessible to unemployed people who do not have an automobile is an objective that must be partially satisfied before the ultimate objective of increasing the rate of employment among these people can be attained. A transit service may be able to accomplish the first objective to a high degree but fail to increase the rate of employment significantly, since many factors besides a lack of transportation can prevent someone from getting a job. Transit objectives may be set to achieve the intermediate result; planners and decisionmakers, however, should be careful to evaluate whether a combination of actions is required to achieve the ultimate result. In the above example, a trade school or an educational program may be necessary to improve the skill level of unemployed residents to increase their opportunities in the job market.

The distinction between intermediate and ultimate objectives underscores the importance of the objective of penetrating the intended market. Before certain objectives such as reducing the demand for parking space or reducing traffic congestion can begin to be accomplished, the more immediate objective of attracting a significant number of riders must be achieved.

f. Objectives pertaining to the performance or quality of a transit service should be based on a careful appraisal of the underlying problem and particularly on the special needs and preferences of the intended market.

For example, if the intended market consists of upper-income workers who drive alone to work, an important objective may be one that specifies the desired speed of the service relative to the speed by automobile. A commonly used criterion is the level of service ratio, the total travel time for a trip by transit divided by the total travel time for the same trip by automobile. However, the physically handicapped are probably less concerned about the speed of a transit service and more concerned about their comfort and safety. To ensure their comfort and safety, one of the objectives of any transit service for these people may be to meet the applicable standards adopted by the American National Standards Institute for making buildings and facilities accessible to and usable by the physically handicapped[1] or the standards proposed by the Urban Mass Transportation Administration (UMTA) for making public transportation vehicles and facilities accessible to the handicapped.[2]

g. The set of objectives should be comprehensive.

This is the most difficult guideline to follow, since no one can be absolutely sure that all possible objectives have been considered. Most likely to be missing are objectives pertaining to the undesirable side effects to be avoided, since the impact of a transit service on other components of the transportation system and on the other urban systems is not fully known.

There are at least three ways to reduce the chances that some important objectives may be excluded. One is to carefully study

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[1] American National Standards Institute, Inc., American National Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped, ANSI A 117.1 - 1961 (R 1971) (New York: American National Standards Institute, Inc., 1961).

[2] U.S. Department of Transportation, Urban Mass Transportation Administration, "Transportation for Elderly and Handicapped Persons," Federal Register, Vol. 41, No. 85 (April 30, 1976), pp. 18233-18241.

all of the aspects of the problem to be solved and the needs of the intended market. Another way is to be innovative and consider as many alternative services as possible. The third is to seek the views of all parties likely to be affected by a new or improved transit service. These could include taxi operators, regular bus transit operators, charter bus companies, rental agencies, social organizations and health care agencies that provide transportation for their clientele, public and private agencies and firms that provide or sponsor conventional transit or paratransit services for their employees, regulatory agencies, insurance companies, and persons or organizations representing people in the intended market. Through these efforts, hidden problems, conflicts, and other ramifications of a new or improved transit service may become apparent and be incorporated into the set of objectives.

h. The first set of objectives developed should not be considered final.

There is always the possibility that none of the alternative solutions will enable attainment of all of the objectives and that some of the objectives will be conflicting. The matter then becomes one of deciding which objectives are more important, deleting unattainable objectives, and rephrasing some others. If an objective cannot be attained by any of the alternatives considered, additional alternatives should be examined or the objective should be discarded.

i. Finally, whenever the performance of a transit service is evaluated, the objectives of the service should be re-examined.

The objectives may change over time, and the service itself may have to change accordingly. New technology, economic trends, new laws and public policies, changes in the attitudes and preferences of consumers of transportation services, and numerous other factors can dictate the need for revisions in the original objectives and in the means of achieving them.

4. Formulation of Transit Service Objectives: An Example

There are two reasons for formulating transit service objectives. First, if the objectives of a transit service are unspecified, its performance cannot be evaluated fully, and the need for it can always be questioned. Second, clearly specified objectives should assist the community planner and decisionmaker in the development of appropriate transit service opportunities and in the determination of reasonable levels of transit service for the community.

To fulfill these two purposes, objectives should reflect the problem to be solved and the desired consequences or level of performance of any proposed solution to the problem. The first step in formulating transit service objectives, therefore, is the identification of community problems or needs which may be addressed by transit service.

For example, a typical community goal for transportation is to provide for the efficient, economic, safe, and equitable movement of people and goods within the community (see Figure III-3). This goal, like all goals, is vague and general; it can never be fully achieved. It is, however, useful as a general expression of the community's values.

Many communities share this goal for transportation. Each individual community, however, has a different social, political, and financial character which influences its tolerance for deviations from the ideals represented by this goal. For example, whereas traffic congestion represents a shortfall from the goal of efficient movement of people and goods within the community, traffic congestion as a problem to be solved is likely to mean something quite different in different communities (e.g., Lafayette, Indiana, as compared to New York City). In each community, however, there are typically certain facilities which are considered to be congested during certain periods of the day and which therefore represent problems that may be addressed by considering the implementation or expansion of transit service. The identification of such problems or issues is the key to the development and evaluation of transit service alternatives.

In general, planners and decisionmakers should consult with residents and community leaders to determine the nature and extent of specific transportation problems in the urban area. Typical problems include traffic congestion, parking congestion, and lack of mobility for certain urban area residents. To the extent possible, specific problems such as these should be defined in sufficient detail to permit the explicit description of the desired outcome of any proposed solution. For example, the location of the problem (in this example, the CBD), if applicable, the time(s) when the problem occurs (in this example, AM and PM rush hours), and the specific market to be addressed (in this example, employed residents commuting to the CBD) should be identified. Specification of the problem at this level of detail facilitates the identification of specific transportation objectives, criteria for measuring the achievement of these objectives, and, possibly, standards of performance for alternative solutions.

As discussed previously, a standard is that value of a criterion or the level of attainment above or below which an alternative solution is acceptable. In the example illustrated in Figure III-3, a possible standard

| | |
|---|---|
| **Community Goal for Transportation:** | Efficient, economic, safe, and equitable movement of people and goods within the community. |
| **Urban Transportation Problem:** | Traffic congestion in the Central Business District (CBD) during the AM and PM rush hours. Note that this is a problem only to the extent that traffic in the CBD during the AM and PM rush hours exceeds the community's tolerance for this condition. The community's tolerance depends on several factors, including the expense involved to improve traffic flow conditions. Traffic congestion as a problem to be solved is likely to mean something different in each urban community. |
| **Transportation Objective:** | Reduce traffic congestion in the CBD during the AM and PM rush hours. |
| **Possible Criteria for Measuring Achievement of Objective:** | Improvements in traffic flow conditions in the CBD during the AM and PM rush hours. |
| **Possible Standard of Performance for Alternative Solutions:** | Stable flow at typical design volumes (Level of Service B).[1] |
| **Transit Solution:** | Provide, promote, or sponsor transit service alternatives to the single-occupant automobile for making AM/PM rush hour work trips to and from the CBD. |
| **Transit Service Objective:** | Reduce auto trips to the level necessary to achieve the standard of performance set for alternative solutions to the transportation problem. |
| **Possible Criteria for Measuring the Transit Solution's Achievement of the Transportation Objective:** | Single-occupant auto trips diverted to transit alternative (reduction in single-occupant auto work trips). |
| **OTHER POSSIBLE (complementary or substitute) SOLUTIONS:** | Staggered working hours.<br>Dispersion of CBD employment.<br>Traffic engineering improvements. |

[1]Institute of Traffic Engineers, Transportation and Traffic Engineering Handbook (New Jersey: Prentice Hall, 1976) 315.

**FIGURE III-3: GENERATION OF TRANSIT SERVICE OBJECTIVES**

of performance is suggested as stable flow at typical design volumes for the street network. Standards are closely related to the definition of a problem in the community; they represent not only the level of performance the community expects of the transportation system, but also the level of performance the community is willing to pay for. Consequently, standards, like problems, will vary from community to community and in fact will vary within a community depending on the availability of financial resources and the nature and extent of other services (e.g., educational, police, and fire) that require the investment of these limited resources. Standards may in fact be constrained explicitly by budgetary considerations. An alternative standard in this example might be stated as follows: improve traffic flow conditions as much as possible but limit the expenditure of public financial resources on a solution to this problem to $X or to $X per year.

Once the transportation problem is identified and the transportation objective determined, alternative solutions may be considered. In this example, transit service is a possible solution because increasing the occupancy of vehicles would tend to alleviate the congestion problem. It is important to note that the transit solution suggests transit service as an alternative to the single occupant automobile, the principal cause of the congestion problem. Also, the transit solution suggests three alternative mechanisms for community involvement (provide, promote, or sponsor transit service) and does not suggest specific transit modal alternatives. This permits consideration of a wide variety of transit options that vary from public provision of line-haul transit service between residential areas and the CBD to community sponsorship and promotion of car pooling programs. However, each transit solution possible has the same transit service objective: reduction of auto trips to the level necessary to achieve the standard of performance set for alternative solutions to the transportation problem. Individual alternatives are compared on the basis of two criteria: objective attainment and expenditure of financial resources.

A very important point illustrated by the example in Figure III-3 is the need to consider other possible solutions to the transportation problem. Transit service is often promoted as a solution to a wide variety of community problems, and other possible solutions are given minimal consideration or are totally overlooked. It is imperative that these alternatives be given serious consideration by small urban community planners and decisionmakers. Many times, no single alternative is sufficient for achieving the transportation objective, and a set of complementary alternatives needs to be considered.

## C. Inventory of Existing Conditions

The motivation for initiation or expansion of transit services in small urban communities should be related to specific local transit service objectives. Objectives that are used to justify transit service in larger urban areas (e.g., reduction of traffic congestion, energy consumption, and environmental deterioration), however, are typically not sufficient justification for transit service in small urban communities. Instead, the role of transit in small urban communities is usually that of a service provided to improve the mobility of those residents who do not have convenient access to an automobile.

The specific objectives for transit service in different small urban communities, however, may vary substantially. These specific local transit service objectives depend on two factors:

- the nature of existing transportation services in the community and the need for additional and complementary transit services; and

- economic, institutional, and other factors that may influence the decision to initiate or expand certain transit alternatives.

To determine the nature of these factors and their relation to the development of meaningful local objectives for transit service, an inventory of existing conditions should be conducted as part of the transit planning process. Such an inventory is necessary to identify problems and needs that present opportunities for new or improved transit services and to assess the characteristics of a small urban community that may affect the design and operation of any transit service.

### 1. Major Inventories

The analysis of existing conditions in a small urban community can be facilitated by preparing inventories of population characteristics, land use characteristics, existing transit services, institutional factors, and other conditions relevant to the initiation or expansion of local transit services. Most of these inventories can be prepared using readily available sources of data; many are likely to have already been prepared as part of the planning activity for other local services. In many cases, these inventories can consist of a brief listing of characteristics; the listings need not be particularly elegant or extensive. Again, the reason for preparing these inventories should be remembered: they are prepared to determine the nature of existing conditions so that the objectives

of transit service can be formulated on a rational basis. The inventory of existing conditions should therefore result in the identification of the needs and opportunities for implementing, expanding, or modifying transit services in the small urban community. Significant amounts of time, money, and effort need not be expended preparing these inventories.

Specific items of information and the purpose for obtaining them are identified in Tables III-1 through III-5 for each major inventory discussed above.

a. Inventory of Population Characteristics

The inventory of population characteristics should result in a profile of the small urban community based on at least three items: age, income, and auto ownership. It should also include the number and location of physically and mentally handicapped residents, summarized by census tract, traffic zone, or some other small area unit.

The reason for preparing this profile is to locate potential transit tripmakers by the characteristics that are known both to influence transit use and to differentiate the demand for alternative transit service characteristics. For example, areas of the community that have low auto ownership and a high proportion of very young residents will be more likely to require and consequently use transit services than areas with high auto ownership and a predominantly middle-aged population base. These areas will furthermore normally demand a different set of transit service characteristics than those required to serve the mobility requirements of the community's physically or mentally handicapped residents.

b. Inventory of Land Use Characteristics

The inventory of land use characteristics should result in a profile of the small urban community's major activity centers and land use development patterns. The type and concentration of land use in various parts of the small urban community exert substantial influence on tripmaking activity. A strong CBD and clustered residential development in the periphery of the CBD, for example, generate a corridor-oriented tripmaking activity to and from work during the week. Dispersed industrial and commercial development, on the other hand, normally generates a more even geographic distribution of tripmaking activity to and from work. Each of these land use patterns has important implications for the design of transit service alternatives.

## TABLE III-1

## INVENTORY OF POPULATION CHARACTERISTICS

| INVENTORY | REASON FOR INCLUDING AS PART OF THE INVENTORY OF EXISTING CONDITIONS |
|---|---|
| Age distribution of resident population (especially over 65 and below driving age) | The largest segment of transit users in small urban communities typically consists of those residents for whom auto travel is not possible or who do not have convenient access to an automobile. The elderly (especially those over age 65) and the young (especially those below driving age) represent two groups whose urban mobility could be improved significantly by the availability of transit service. In addition, tripmaking characteristics and attitudes toward various attributes of transit service vary for different age groups, and both of these factors are important when planning transit initiation or expansion. |
| Income distribution of residents (family, household, or individual income; especially families below the poverty level) | The lack of mobility of the poor is often cited as one cause for remaining poor. As discussed in the section on goals and objectives, transit service may be necessary to improve the mobility of poor residents; it does not, however, guarantee that these residents will be able to obtain the employment required to improve their economic condition. Again, the tripmaking characteristics and attitudes toward various attributes of transit service vary for residents in different income classes. |
| Auto ownership (family or household) | Auto ownership exerts a strong influence on transit use in small (and large) urban communities. Families that do not have an auto must rely on neighbors or friends, taxis, or other forms of transit for their mobility. Often these families are simply less mobile than families that have one automobile or more. Families with one auto typically use that vehicle to serve the travel needs of the employed family member, leaving the rest of the family immobile or dependent on neighbors and friends, taxis, or other forms of transit for their mobility. |
| Distribution of physically or mentally handicapped residents | Many residents with physical or mental handicaps are unable to use the automobile. These residents must rely on friends, or neighbors, taxis, or other forms of transit to fulfill their mobility requirements, which in many cases are highly specialized. |

## TABLE III-2

## INVENTORY OF LAND USE CHARACTERISTICS

| INVENTORY ITEM | REASON FOR INCLUDING AS PART OF THE INVENTORY OF EXISTING CONDITIONS |
|---|---|
| Distribution of land by categories of land use (especially industrial, commercial, residential, and park/recreational land uses) | The extent and pattern of tripmaking activities within a small urban community are influenced by the location of different types of land use development. A typical pattern, for example, is the AM and PM work trip flow from residential areas to the Central Business District (commercial land use). The inventory of trip generators (residential areas) and trip attractors (industrial, commercial, and park/recreational areas) assists in identifying opportunities for transit services. |
| Land Use Development Trends | Anticipated changes in the distribution of land use can influence the appropriateness of various transit alternatives. Conversely, if specific land use trends are being encouraged, specific transit service alternatives may complement these trends. |
| Location of important centers of activity (especially:<br>. concentrations of office space;<br>. concentrations of retail space;<br>. industrial plants and parks;<br>. clinics, hospitals, and other health care facilities; and<br>. recreational areas). | This inventory specifically identifies the geographic location of major trip attractors. |

## TABLE III-3

## INVENTORY OF EXISTING TRANSIT SERVICES

| INVENTORY ITEM | REASON FOR INCLUDING AS PART OF THE INVENTORY OF EXISTING CONDITIONS |
|---|---|
| Types of existing transit services:<br>. regular bus service;<br>. express bus service;<br>. taxi and other demand-responsive service;<br>. charter bus service;<br>. commuter bus clubs or bus pools;<br>. van pool programs;<br>. formal car pool programs; and<br>. special services for the elderly, the handicapped, school children, and other special groups. | Before new or expanded transit services are considered, a complete inventory of existing transit services should be prepared. |
| Supply characteristics of existing transit services:<br>. service characteristics, especially:<br>. schedules (if pertinent);<br>. routes, including number, length, and configuration (if pertinent);<br>. service areas;<br>. means of access (door-to-door, etc.);<br>. shared ride, group ride, or single passenger;<br>. manner of requesting service;<br>. type of reservation;<br>. origins and destinations served;<br>. eligible users;<br>. eligible trips;<br>. hours and days of operation; and<br>. fares (level and method of payment).<br>. operating statistics;<br>. average number of vehicles in operation per day;<br>. average number of vehicle-hours operated per day; and<br>. average number of vehicle-miles operated per day;<br>. facilities and equipment, especially:<br>. real estate owned or rented (office, maintenance, vehicle storage, dispatching facilities, etc.); | The inventory of supply characteristics is prepared to determine the specific nature of transit services provided in the urban community. This inventory, together with the inventory of population characteristics, land use characteristics, and the demand characteristics of existing transit services, should assist in the identification of opportunities for new services or improvements to existing services. |

TABLE III-3 (Continued)

| INVENTORY ITEM | REASON FOR INCLUDING AS PART OF THE INVENTORY OF EXISTING CONDITIONS |
|---|---|
| . street furniture (bus shelters, benches, route markers, etc.); and<br>. vehicles [number, type (taxicab, van, small bus, etc.), age, capacity (seating, total), owner (transit authority, charter bus company, taxi operator, rental agency, etc.)]. | |
| Demand characteristics of existing transit services:<br>. ridership:<br>. age;<br>. sex;<br>. income;<br>. trip purpose;<br>. time of day; and<br>. total.<br>. vehicle productivity (person-trips per vehicle per hour). | The demand characteristics of existing transit services are inventoried (to the extent possible) to determine the proportion of the total tripmaking market currently served by transit and the composition of the existing transit market. Comparison of this profile with the population characteristics inventory and the land use characteristics inventory should assist in identifying potential new opportunities for transit services and candidates for revision of existing transit services. |
| Administrative characteristics of existing transit services:<br>. sponsor, i.e., entity or entities that provide some form of support (usually financial) for transit service;<br>. operator, i.e., entity or entities that operate the transit services; and<br>. manager, i.e., entity or entities that manage the transit services. | The sponsors, operators, and managers of existing transit services all play major roles in shaping the character of the services. As part of the inventory, these roles should be identified. |
| Financial characteristics of existing transit services:<br>. capital costs;<br>. operating expenses; and<br>. operating revenues. | The financial condition of existing transit services should serve as one indication of the vitality of the services. |

## TABLE III-4

## INVENTORY OF RELEVANT INSTITUTIONAL FACTORS

| INVENTORY ITEM | REASON FOR INCLUDING AS PART OF THE INVENTORY OF EXISTING CONDITIONS |
|---|---|
| Laws, regulations, ordinances influencing existing or potential transit services:<br>. Interstate Commerce Commission regulations;<br>. Intrastate Commerce regulations;<br>. Public Utilities Commission regulations;<br>. taxicab ordinances;<br>. antijitney ordinances;<br>. state and local laws concerning taxing and bonding authority;<br>. state and local laws concerning ownership and operating entities; and<br>. federal laws and regulations. | Laws, regulations, and ordinances may have a significant influence on the design and operation of existing and potential transit services. For example, taxicab ordinances often specify the number of taxicabs that may operate in the community, set fare levels and structures, and constrain the number of passengers that may be served at any one time. |
| Other institutional factors influencing existing or potential transit services:<br>. insurance requirements;<br>. licensing requirements; and<br>. transit labor contracts. | Insurance requirements, licensing requirements, and transit labor contracts are three examples of factors in the institutional environment that influence the design, operation, and expense of alternative transit services. |

## TABLE III-5

## INVENTORY OF OTHER RELEVANT CHARACTERISTICS

| INVENTORY ITEM | REASON FOR INCLUDING AS PART OF THE INVENTORY OF EXISTING CONDITIONS |
|---|---|
| **Local Economic Conditions:**<br>. inflation rate;<br>. employment rate and trends in employment; and<br>. price and supply of fuel.<br><br>**Community Goals for Transit Service**<br><br>**Popular Support for Transit Services** | Each of these inventory items is obtained to prepare an assessment of the small urban community's commitment to sponsor, promote, or provide transit services. |

c. Inventory of Existing Transit Services

Before new or expanded transit services are considered, a complete inventory of existing transit services should be prepared. The inventory should include a comprehensive review of the range of transit alternatives operating in the small urban community. This review, together with the inventory of population and land use characteristics, forms the basis for assessing the need for new or expanded transit services.

Special attention should be directed towards identifying all forms of transit service in the community, including taxi services; organized bus, van, and car pool programs; and special services for the elderly and handicapped residents of the community. For each type of transit service operating in the community, the inventory should include a description of their supply, demand, administrative, and financial characteristics. To determine the need for new or expanded services, it is necessary to know both the demand for transit service and the degree to which existing transit service in the community is satisfying that demand. The latter issue is at least partially addressed by summarizing the characteristics of transit services supplied in the community and by relating these characteristics to the population and land use profiles of the community.

Various survey techniques may be used to provide information about existing and potential transit demand, existing transit operations, and the inventory of transit supply. Table III-6 lists specific inventory items within these categories and references for survey techniques to obtain these data items.

d. Inventory of Institutional Factors

Transit services in any community are provided in an environment of institutional factors, some of which constrain the design and development of certain transit alternatives and others of which enhance and encourage the development of other transit services. For example, many urban areas have enacted ordinances that limit the number of taxicabs that may provide service in the community.

To conduct a rational analysis of transit service opportunities, the implications of various local, state, and federal institutional factors must be understood by the small community planner and decision-maker. It is essential, therefore, that the transit planning process include the preparation of an inventory of these factors and their implications for transit development in the community.

# TABLE III-6
# TRANSIT SURVEY TECHNIQUES

| INVENTORY DATA ITEM | TYPE OF SURVEY | | | | |
|---|---|---|---|---|---|
| | On-Board Transit Vehicle | | | Stationed Observer | Site Interviews |
| | Observation by Checker | Interview | Self-administered/mail back | | |
| Transit ridership, passenger loads | Refs 1,3,4 | | | Refs 2,3 | |
| Transit ridership, boarding and alighting counts; determination of maximum load points | Refs 1,3,4 | | | | |
| Transit ridership, passenger origins and destinations | Refs 1,2,3 | Refs 3,5 | Refs 3,5 | | |
| Transit ridership, passenger characteristics, access mode, trip purpose, attitudinal factors | | Refs 3,5 | Refs 3,5 | | |
| Transit ridership, potential, shoppers | | | | | Refs 3,5 |
| Transit ridership, potential, employees | | | | | Refs 3,5 |
| Operations, schedule adherence | Refs 1,3,4 | | | Refs 2,3,4 | |
| Operations, running speeds, and delays | Refs 1,2,3,4,5 | | | | |
| Transit supply | | | | Ref 2 | |


References:

1. Manual of Traffic Engineering Studies, Institute of Transportation Engineers, Arlington, Va., Fourth Edition, 1976, pp. 153-170.

2. Homburger, Wolfgang S., Urban Mass Transit Planning, The Institute of Transportation and Traffic Engineering, Univ. of Calif., Berkeley, Calif., 1967, pp. 23-48.

3. "Manual of Transit and Traffic Studies," American Transit Association, Washington, D.C., 1947.

4. National Committee on Urban Transportation, "Measuring Transit Service," Procedure Manual 4A, Public Administration Service, Chicago, Ill., 1958.

5. Urban Transportation Systems Associates, Inc., Urban Mass Transportation Travel Surveys, Report prepared for Federal Highway Administration in cooperation with Urban Mass Transportation Administration, Washington, D.C., August 1972 (available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 5001-00037; also available through National Technical Information Service, U.S. Department of Commerce, Springfield, Va. 22161, Item Number PB 220-199).

e. Inventory of Other Relevant Characteristics

Many other factors influence the decision to initiate or expand transit services in a small urban community. Local economic conditions, popular support for transit service, and other community goals and objectives together form the basis for determining the urban community's commitment to sponsor, promote, or provide transit service. Without a sustained local commitment, it is difficult if not impossible to obtain financial resources, citizen support, and the cooperation of other community agencies. For this reason it is essential that the small urban community planner and decisionmaker obtain information regarding these other relevant characteristics when preparing the inventory of existing conditions.

2. Identification of Transit Markets

To offer an effective solution to community problems, transit service must attract riders. Transit services must therefore be implemented where, and in a manner in which, they capture a significant portion of the market they are intended to serve. To accomplish this objective, the examination of existing conditions should include a description and assessment of the potential local market for transit services.

a. The Need for Market Segmentation

For several reasons, it is appropriate to prepare the description of local transit market potential by partitioning the total local transit market into market segments. One reason for segmenting the total transit market is that often, in recognition of a particularly important mobility need, local transit service objectives are specifically oriented to serving a particular socioeconomic group of residents. A second reason for market segmentation is to assist in the achievement of community objectives. Market segments can be identified based on community objectives for transit service, and transit service alternatives under consideration can be evaluated based on the degree to which these markets are served by and patronize each alternative. A third reason for market segmentation is to concentrate the supply of existing transit services on those markets where the greatest ridership can be achieved at the least cost, that is, to maximize the cost effectiveness of transit service.

b. Captive and Noncaptive Transit Markets

Traditionally, the market for transit service has been divided into two segments: captive and noncaptive (i.e., choice) markets. The captive market consists of those residents who are transportation-disadvantaged, that is, who do not have convenient access to or who cannot use an automobile. This market normally consists of a large proportion of residents from the following groups:

- senior citizens;
- children and adolescents;
- the physically or mentally handicapped; and
- persons with low incomes.

The noncaptive market consists of those residents who have a choice between using a private automobile and some form of conventional transit or paratransit service.

Using only these two market segments to plan and design transit services in small urban communities does present certain problems, however. One is that both markets are highly heterogeneous. Persons in the captive market, for example, differ considerably in their ability to pay for transportation services, their physical capabilities to use various transportation alternatives, and their mobility requirements. Even physically or mentally handicapped persons differ considerably in each of these respects. Another problem is that these two market segments cannot be defined simply in terms of age, income, physical ability, other personal characteristics, or even auto ownership. For example, an automobile owner would typically be considered a member of the choice market. At times when the automobile is not available, however, this person temporarily becomes a member of the captive market. In this situation, the auto owner would be forced to use some form of transit, rely on neighbors or friends for travel assistance, or sacrifice some mobility.

c. Transit Markets in Small Urban Communities

Because the partitioning of the total transit market into captive and noncaptive segments is problematic and therefore not very useful, other transit market segments should be identified. Additional market segments may be defined, for example, by trip purpose (work,

shop, recreation, etc.) trip destination (CBD, major employment center, school, etc.), and type of tripmaker (elderly, handicapped, etc.). Using these characteristics, Table III-7 presents a list of 17 typical transit markets in small urban communities. The list is not representative of all of the markets for transit service that a small urban community may wish to analyze, but it does include the major markets typically served by transit systems (e.g., the CBD work trip market) and is intended to suggest other market segments that could present opportunities for transit service implementation, expansion, or modification. The small urban community planner and decisionmaker should use their special knowledge of the local area to determine the most appropriate markets to analyze in each particular situation. In this regard, it is important to remember that, to offer an effective solution to community problems (i.e., to achieve transit service objectives), transit must attract riders. Market segments should therefore be identified to assist planners and decisionmakers in determining rational objectives for transit service that are consistent with community needs.

## TABLE III-7

## TYPICAL SMALL URBAN COMMUNITY TRANSIT MARKETS

| Transit Market | Trip Purpose | Trip Destination | Tripmaker |
|---|---|---|---|
| 1 | work | Central Business District | employed resident |
| 2 | work | non-CBD large employment center | employed resident |
| 3 | work | nearby regional employment center | employed resident |
| 4 | work | dispersed employment opportunities | employed resident |
| 5 | shop (nongrocery) | retail establishment | all residents |
| 6 | shop (grocery) | grocery store | all residents |
| 7 | school | local high school | student (aged 12 through 17 years) |
| 8 | school | local university | university student |
| 9 | nonschool | multiple opportunities | resident (aged 12 through 17 years) |
| 10 | social/recreational | museum, theater, movie, restaurant, etc. | all residents |
| 11 | social, recreational, shop, personal business | multiple opportunities | tourists and business visitors |
| 12 | intercity terminal access | bus station, railroad station, airport | all residents |
| 13 | small goods movement (package delivery) | multiple opportunities | — — — — |
| 14 | all | multiple opportunities | elderly resident |
| 15 | all | multiple opportunities | low income resident |
| 16 | all | multiple opportunities | physically handicapped resident |
| 17 | all | multiple opportunities | mentally handicapped resident |

Chapter IV

# FORMULATING TRANSIT SERVICE OPPORTUNITIES

## A. Introduction

After specific local problems or needs for transit service are identified, the range of transit service alternatives available for solving these problems and satisfying these needs must be considered. Alternative transit services are often identified by the technology or hardware used to provide the service. However, a particular technology could provide different transit services, with different costs and benefits associated with each service. Conversely, two distinctly different technologies could provide the same service although probably at different costs.

In this chapter 25 elements of a transit service are defined, and seven basic forms of transit service (transit service options) suitable for consideration in small urban communities are described in terms of these elements. This chapter concludes with a discussion that relates the features of these basic transit service options to their suitability for solving certain problems and satisfying specific needs in the community.

## B. Transit Service Options

No single transit service is likely to meet every transportation need in a community. However, if the characteristics of a particular service do not match the requirements of a sufficient number of people in a particular market, the service is not likely to attract as many riders as it should and will probably not realize its objectives. In such a situation, there is an obvious need for a means of transportation that is more suited to the needs of the particular market. Anyone involved in short-range transit planning for the community should recognize that a variety of transit services may have to be provided to satisfy the community's transit service objectives.

In this section, the range of characteristics which define the variety of transit service alternatives is described, a general description of the basic transit service options suitable for consideration in small urban communities is presented, and examples of these basic service options are given. Chapter VII of this manual presents data and statistics which describe the characteristics of the service options in greater detail.

### 1. The Elements of a Transit Service

Alternative transit services are often identified by the technology or hardware (e.g., bus transit, taxicab, dial-a-bus, personal rapid

transit) used to provide the service. However, although the type of vehicle or technology used is an important element of a transit service, it should not necessarily be the first consideration in developing a transit service and certainly should not be the only consideration. Consumers of transit services are normally less concerned with transit technology than with the service the technology provides.

Transit services differ in many respects. At least 25 elements of a transit service distinguish it not only from different vehicular modes of transportation but also from other transit services that use virtually the same technology.

Table IV-1 presents a brief description of each of these elements of a transit service and illustrates the many different ways they can be combined to form transit service options. In the following paragraphs, some of the most common forms of urban transit service are described in terms of these elements.

## 2. Description of Basic Transit Service Options

The above elements of a transit service may be used to describe basic transit service alternatives for potential consideration by a small urban community. These descriptions indicate the numerous possibilities for innovation in transit service design. Innovation does not simply mean new technology. It also means new concepts of service and new uses of existing technology. The fundamental challenge of short-range transit planning is to use existing services and facilities in innovative ways to meet the transportation needs of the community more fully. Because new concepts of transit are likely to arise in the future in response to changing consumer preferences and conditions in the community, the following discussion does not contain a complete list of all possible transit services. However, the discussion is intended to show the variety of transit services that can operate in a small urban community.

Table IV-2 illustrates the way the 25 elements of a transit service combine to form seven common types of transit service suitable for consideration in a small urban community. The seven basic transit service options described in this table are:

- demand responsive transportation (DRT) services;
- jitney services;
- car pools;

## TABLE IV-1

## BRIEF DESCRIPTION OF THE ELEMENTS OF A TRANSIT SERVICE

| Transit Service Element | Description of Options |
|---|---|
| 1. Service Schedules | Many transit services operate on an established "fixed" schedule, while others operate on an irregular schedule or with no schedule at all. Many services in the latter group revise their schedules constantly in response to changes in demand. |
| 2. Service Routes | At one extreme, a transit vehicle may operate on a fixed route at all times, while at the other extreme, a transit vehicle may operate along any path necessary to serve the demand. There are, however, at least two variations of fixed-route service. One variation, known as route deviation, allows the vehicle to deviate from the fixed route to collect or deliver a passenger at his or her request. The second variation, known as point deviation, does not confine a vehicle to a fixed route but does require it to travel past designated checkpoints in succession and perhaps to stop at each one. Between checkpoints, however, the vehicle may traverse any path necessary to serve its customers. |
| 3. Access to and from the Service | Some forms of transit provide door-to-door service, eliminating the problem which the user might otherwise have of reaching the vehicle from one or both ends of a trip. Other transit services may be available from the doorstep at one end of the trip only, implying that some means of access may be necessary at the other end. Reaching the service may only involve walking one or two blocks or it may entail using another vehicular mode of transportation. Many transit services require most of their users to find some means of access at both ends of a trip. |
| 4. Transferring or Changing Modes | This element, like the preceding one, can often deter people from using a particular transit service. Using certain transit services, the traveler may have to transfer to another vehicle of the same service or to an entirely different vehicular mode of transportation to complete a trip. A few transit services, in fact, may always require transferring because of their function (feeder services, for example). There are many forms of transit, however, which never require a transfer under normal circumstances. |
| 5. Vehicle Occupancy | Most forms of transit are intended to carry more than one passenger at a time. There are two distinct situations involving multiple occupancy of a vehicle. The first situation, known as shared-ride, occurs when the passengers sharing the vehicle pay separate fares. Local bus transit is a familiar example of a shared-ride service. When two or more travelers pay a single fare or somehow share the cost of a trip as a group, they create a situation known as group-riding or pooling. The distinction between shared-riding and group-riding is important because certain transit services provide only shared-ride service, others accommodate only groups or pools of travelers, and still others combine groups and separate passengers in the vehicle. There is at least one form of transit service, the taxicab, that typically carries only one passenger at a time, either by the operator's choice or by regulation. A few transit services may offer the traveler the choice of shared-riding, group-riding, or sole use of the vehicle with a different price for each type of service. |

TABLE IV-1 (Continued)

| Transit Service Element | Description of Options |
|---|---|
| 6. Manner of Requesting Service | Transit services differ considerably in the ways in which they are requested. Possible ways of obtaining transit service include hailing a vehicle, phoning the service operator, being present at a designated location, registering for the service, or being contacted by the entity providing the service. Some transit services can be requested in only one way, others can be requested in different ways in different situations, and still others offer the traveler a choice of ways in any given situation. |
| 7. Type of Reservation | Most of the transit services that are requested either by hailing a vehicle or by being present at a designated location do not require a reservation, while those that are requested by a phone call or by registration normally do. There are two general types of reservations: (1) a request for immediate service or for service as soon as possible, and (2) a reservation made well in advance of the trip. The latter type includes several other possibilities. Under one alternative, known as a request for deferred service, the traveler notifies the transit service in advance of each trip and specifies the time at which he or she desires to use the service. A request for deferred service, therefore, is made at the traveler's own discretion. Many transit services, however, require the traveler to make an advance reservation before each trip. The amount of lead time required may be as little as 20 to 30 minutes or as much as one or two days. For trips that are regularly taken at the same time and between the same two places, the traveler may be able to subscribe to the transit service. With a subscription, the traveler requests the service only once, receiving it automatically thereafter for either a definite or an indefinite period of time. |
| 8. Stopping for Passengers | Intermediate stops to collect and discharge passengers can sharply increase a rider's travel time. Many transit services are designed to make stops throughout the length of a vehicle's run. The number of stops may be numerous or few. Other transit services provide a faster trip by concentrating all intermediate stops at one or both ends of a vehicle's run so that a major portion of a passenger's trip is nonstop. There are some transit services that are completely nonstop; they make no intermediate stops for passengers between the ends of a rider's trip. |
| 9. Availability of Seats | Different forms of transit either may or may not be able to guarantee a seat for each passenger. |
| 10. Availability of Baggage Space | Some of the more personalized forms of transit provide space for storing baggage or personal belongings. Many transit services, however, make no special provisions for baggage and for this reason can be very inconvenient in crowded situations. |
| 11. Need for Parking | For most conventional modes of transit, there is no need for parking at the end of a trip — an often-cited advantage of these modes to city travelers. A few specialized transit services, however, do encounter a need for parking at the end of a trip. In some cases parking may even be a direct concern to the travelers. |
| 12. Availability of Personal Assistance | Except for providing information about the service, most mass transit services normally do not physically assist the passengers in any way. The lack of this kind of assistance can prevent many handicapped persons from using the service. Some of the more personalized or highly specialized forms of transit, however, do routinely offer some form of assistance to a passenger. For example, a driver may assist in the handling of baggage or escort a passenger to and from the vehicle. |

## TABLE IV-1 (Continued)

| Transit Service Element | Description of Options |
|---|---|
| **13. Area Coverage** | The area covered by a transit service within a community should depend on the function of that service and the location of its markets. A transit service, therefore, does not have to serve an entire community to be useful. Many modes of transit can operate effectively within a small section of the community such as a residential area or the downtown area. Other modes may operate only along a few major corridors bounded by dense residential and commercial developments. Still other modes may link two or more small areas or major facilities such as a residential area, the downtown area, an industrial park, a manufacturing plant, a shopping center, and a transfer point to another vehicular mode of travel. |
| **14. Origins and Destinations Served** | Riders may have access to a particular transit service at either one, a few, or many locations and be able to travel to either one, a few, or many destinations within the areas served. A transit service can be classified into one of the following nine general categories according to the number of places where it can be obtained within its service area and the number of destinations it serves:<br>. Many to many – between many places of access and many destinations<br>. Many to few – between many places of access and a few destinations<br>. Many to one – between many places of access and only one destination<br>. Few to many – between a few places of access and many destinations<br>. Few to few – between a few places of access and a few destinations<br>. Few to one – between a few places of access and only one destination<br>. One to many – between one place of access and many destinations<br>. One to few – between one place of access and a few destinations<br>. One to one – between one place of access and one destination |
| **15. Eligible Users** | Just as a transit service does not have to be areawide to be useful or successful, it does not have to convey every type of traveler within its service area. Many transit services are ostensibly designed to be used by anyone in the areas served. Others likewise do not explicitly restrict the types of people that can use the service, but certain other elements of the service may have that effect. For example, a particular transit service may be designed in such a way that it could only be easily used by persons commuting to work in the downtown area, although the driver would not prevent anyone else from riding. There are, of course, many highly specialized transit services that do transport only certain designated types of people such as employees of a particular firm, persons over 65 years of age, or the physically handicapped. |
| **16. Eligible Trips** | The more familiar forms of bus and taxicab transit can normally be used for any type of trip (e.g., work, shopping, banking, medical appointments). The more highly specialized transit services, however, usually accommodate only certain types of trips. Some of these latter services may even specify the purposes for which they can or cannot be used. For example, a transit service for the handicapped may be limited to trips for medical purposes only. |
| **17. Hours of Operation** | The possible periods of operation for some transit services may be numerous and may depend primarily on the demand, while the roles of other services may dictate the hours of operation. A transit service, for example, could operate 24 hours a day or only during certain hours (e.g., the rush hours). |

TABLE IV-1 (Continued)

| Transit Service Element | Description of Options |
|---|---|
| 18. Days of Operation | Like the preceding element, the most practical days of operation for a transit service may be decided by other elements such as the eligible users, the eligible trips, the area coverage, and the origins and destinations served. The hours and the days of operation are two very important elements to persons who are dependent on some form of transit. When a service which is suitable to their needs is not provided during certain hours or on certain days, these persons may be denied the opportunity to work, shop, further their education, attend church services, or seek medical help. |
| 19. Driver | Transit drivers, whether full-time or part-time paid professionals or volunteers, are usually independent of the travelers. For certain types of transit service, however, they may be one of the travelers themselves. |
| 20. Vehicles | Virtually any type of vehicle can provide some form of transit service -- passenger cars, station wagons, taxicabs, vans, limousines, and buses of various sizes and seating capacities. The vehicles used may be either standard, modified, retrofitted, or specially equipped. Obviously, some vehicles are more suited for certain purposes than others, although each type of vehicle can provide a range of services. |
| 21. Association with Other Traffic | Transit services operate in mixed traffic or on reserved or exclusive lanes or right-of-way separated from other traffic. In the latter case, the transit vehicles may be separated from other vehicles for either a portion of the run or the entire length of the run. |
| 22. Pricing Scheme (Fare Structure) | The two basic types of fares are the flat fare and the graduated fare. Graduated fares may be based on zones, airline distance, mileage, time, or a combination of mileage and time. Actual fare schedules vary considerably. |
| 23. Method of Payment | There are numerous ways of paying for a transit service. Some of the more common methods include paying cash for each trip; paying the exact amount of cash for each trip; tickets or tokens; weekly, monthly, or other periodic passes; credit cards; payroll deduction; and transportation stamps. The method of payment is often an inherent property of a transit service, although many transit services can and do offer riders a choice of methods. |
| 24. Organization Providing Transit Service | Private carriers, municipal departments, and transit authorities or districts are not the only organizations that provide transit services. There are numerous examples of transit services that are owned, operated, managed, or sponsored by businesses and industries; churches, schools, hospitals, and other institutions; social service and health care agencies; contract carriers, charter bus companies, and transportation brokers; and combinations of these organizations. Even travelers or associations of travelers, acting along or in conjunction with one or more of the above entities, can provide their own transit services. |
| 25. User Control Over Service Elements | Riders may have complete control, a degree of control, or absolutely no control over the elements of a transit service. When the travelers themselves or representatives of the travelers organize the service, they often determine the routes, schedules, origins and destinations, vehicles, eligible users and trips, pricing scheme, method of payment, and other elements of the service, or at least strongly influence the determination of many of these elements. The consumers generally have less control of influence over the elements of a transit service that is provided by an organization independent of the consumer. The degree of control exercised by a traveler is often a function of how personalized or highly specialized the service is. The latitude given to a potential rider can determine the success of a transit service. Conventional mass transit carriers often have difficulty attracting riders because potential riders must modify their needs to conform with the elements of the service. |

## TABLE IV-2

## TYPICAL CHARACTERISTICS OF SEVEN COMMON FORMS OF TRANSIT SERVICE

| Element of Transit Service | PARATRANSIT SERVICES | | |
|---|---|---|---|
| | Demand Responsive | [illegible] Services | Car Pool Services |
| 12. Personal assistance | Some personal assistance provided; for example, escort to and from vehicle, human or mechanical assistance into and out of vehicle, baggage handling<br>No personal assistance routinely provided | Not routinely provided | Personal assistance possible |
| 13. Areal coverage | Entire community<br>Designated residential areas<br>Designated residential areas and one or more activity centers (Central Business District, industrial complexes, shopping centers, schools, hospitals, mass transit stops and stations) | Selected major streets (commercial and business corridors) | Individual car pools: serve small number of specific locations<br>Car pool programs:<br>Entire community<br>Residential areas and one or more activity centers (Central Business District, office complexes, industrial complexes, schools, shopping areas) |
| 14. Origins and destinations | Many-to-many<br>Many-to-few<br>Many-to-one | Many-to-many | Few-to-many (or one-to-few)<br>Few-to-few<br>One-to-one |

[1]Demand-responsive transportation services include route deviation services, point deviation services, regular taxicab services, shared ride taxicab services, and dial-a-ride services.

TABLE IV-2

TYPICAL CHARACTERISTICS OF SEVEN COMMON FORMS OF TRANSIT SERVICE

| Element of Transit Service | PARATRANSIT SERVICES | | |
|---|---|---|---|
| | Demand Responsive Transportation Services[1] | Jitney Services | Car Pool Services |
| 1. Scheduling | Irregular schedule: continuelly adjusted in response to the demand<br>Fixed schedule: regularly scheduled tours of service area (characteristic of many feeder services) | Irregular schedule | Fixed schedule |
| 2. Routing | Variable routes: continuelly adjusted in response to the demand<br>Route deviation: fixed routes with deviation on demand<br>Point deviation: fixed checkpoints with variable routes in between | Fixed routes<br>Fixed routes with deviation on demand at the terminal or along selected sections | Relatively fixed routes: deviation from regular route possible to avoid abnormally congested traffic |
| 3. Access to and from service | Door-to-door service<br>Doorstep service at one and of trip only (characteristic of some route deviation, point deviation, and shared-ride taxi services) | Walking or another vehicular mode<br>Doorstep service at one and of trip (characteristic of jitneys which deviate from routes) | Door-to-door service<br>Doorstep service at one and of trip only; traveler must walk or use another vehicular mode at other end |
| 4. Transferring or changing modes | Never required to complete a trip within the community<br>May be required (characteristic of services which do not cover entire community and services which confine vehicles to zones)<br>Always required (characteristic of services which are strictly feeder services) | Changing modes may be required to complete trip within community | Changing modes may be required to complete a trip |
| 5. Vehicle occupancy | Shared-ride<br>Single user: only one passenger at a time in a vehicle (conventional taxi)<br>Group-ride (characteristic of many conventional and shared-ride taxi services) | Shared-ride | Group-ride |
| 6. Manner of requesting service | Phone call<br>Hailing (characteristic of many conventional taxi services)<br>Presence at designated locations (route deviation, point deviation, and some conventional and shared-ride taxi services) | Hail<br>Presence at designated locations | Informal personal contacts<br>Registration in car pool program |
| 7. Type of reservation | Request for immediate service<br>Prearranged<br>Request for deferred service: advance notice at user's discretion<br>Advance notice required<br>Subscription | No reservation required | Subscription |
| 8. Stopping for passengers | Intermediate stops en route<br>Completely nonstop (conventional taxi) | Intermediate stops en route | Intermediate stops en route<br>Intermediate stops at one or both ends of the run<br>Completely nonstop |
| 9. Seating | Guaranteed a seat | Guaranteed a seat | Guaranteed a seat |
| 10. Provisions for baggage | Trunk space or other designated storage space<br>No designated storage space | No designated storage space | Trunk space |
| 11. Need for parking | None | None | Parking space required |
| 12. Personal assistance | Some personal assistance provided; for example, escort to and from vehicle, human or mechanical assistance into and out of vehicle, baggage handling<br>No personal assistance routinely provided | Not routinely provided | Personal assistance possible |
| 13. Areal coverage | Entire community<br>Designated residential areas<br>Designated residential areas and one or more activity centers (Central Business District, industrial complexes, shopping centers, schools, hospitals, mass transit stops and stations) | Selected major streets (commercial and business corridors) | Individual car pools: serve small number of specific locations<br>Car pool programs<br>Entire community<br>Residential areas and one or more activity centers (Central Business District, office complexes, industrial complexes, schools, shopping areas) |
| 14. Origins and destinations | Many-to-many<br>Many-to-few<br>Many-to-one | Many-to-many | Few-to-many (or one-to-few)<br>Few-to-few<br>One-to-one |

[1] Demand-responsive transportation services include route deviation services, point deviation services, regular taxicab services, shared ride taxicab services, and dial-a ride services.

TABLE IV-2 (Continued)

| Element | PARATRANSIT SERVICES | | CONVENTIONAL TRANSIT SERVICES | |
|---|---|---|---|---|
| | | | Local Fixed Route | |
| 11. | Parking space required<br>Parking space required temporarily: vans used by other groups between runs | Parking space required<br>Parking space not required or required temporarily: buses used by other groups between runs | None | None |
| 12. | Personal assistance possible | Not provided<br>Provided by driver or by an appointed traveler known as bus captain, bus master, or busmaister | Not routinely provided | Not routinely provided |
| 13. | Individual van pools: serve small number of specific locations<br>Van pool programs: residential areas and activity center (industrial plant, office complex, hospital or other health care facility, school, shopping center or district) | Residential areas and one or more activity centers (Central Business District, industrial plant or complex, office complex, school, hospital or other health care facility, shopping center) | Entire community | Selected residential areas and one or more activity centers (usually Central Business District) |
| 14. | Few-to-one<br>One-to-one<br>Few-to-few | Many-to-many<br>Many-to-few<br>Many-to-one<br>Few-to-few<br>Few-to-one<br>One-to-one | Many-to-many | Many-to-many<br>Many-to-few<br>Many-to-one<br>Few-to-few<br>Few-to-one<br>One-to-one |

TABLE IV-2 (Continued)

| Element of Transit Service | PARATRANSIT SERVICES | | CONVENTIONAL TRANSIT SERVICES | |
|---|---|---|---|---|
| | Van Pool Services | Bus Pool Services | Local Fixed Route Fixed Schedule Bus Services | Express Bus Services |
| 1. | Fixed schedule | Fixed schedule | Fixed schedule | Fixed schedule |
| 2. | Relatively fixed routes. deviation from regular route possible to avoid abnormally congested traffic | Fixed routes | Fixed routes | Fixed routes |
| 3. | Door-to-door service<br>Doorstep service at one end of trip only; traveler must walk or use another vehicular mode at other end | Short walk or some vehicular mode at both ends of trip<br>Doorstep service at one end of trip only; traveler must walk or use another vehicular mode at other end | Short walk or some vehicular mode at both ends of trip | Short walk or some vehicular mode at both ends of trip |
| 4. | Changing modes may be required to complete a trip | Changing modes may be required to complete a trip | Transferring to another bus or changing modes or both may be required to complete a trip within the community | Changing modes may be required to complete a trip within the community |
| 5. | Group-ride | Shared-ride<br>Group-ride | Shared-ride | Shared-ride |
| 6. | Registration in van pool program | Registration in bus pool program<br>Presence at designated locations | Presence at designated locations<br>Hailing a bus (common in small towns where there are no designated bus stops along the routes) | Presence at designated locations |
| 7. | Subscription | Subscription<br>No reservation required | No reservation required | No reservation required |
| 8. | Intermediate stops on route<br>Intermediate stops at one or both ends of the run<br>Completely nonstop | Intermediate stops on route<br>Intermediate stops at one or both ends of the<br>Completely nonstop | Intermediate stops on route | Intermediate stops at one or both ends of run<br>Completely nonstop |
| 9. | Guaranteed a seat | Guaranteed a seat<br>Not guaranteed a seat | Not guaranteed a seat | Not guaranteed a seat |
| 10. | No designated storage space normally | No designated storage space normally provided | None | None |
| 11. | Parking space required<br>Parking space required temporarily: vans used by other groups between runs | Parking space required<br>Parking space not required or required temporarily: buses used by other groups between runs | None | None |
| 12. | Personal assistance possible | Not provided<br>Provided by driver or by an appointed traveler known as bus captain, bus master, or busmaster | Not routinely provided | Not routinely provided |
| 13. | Individual van pools: serve small number of specific locations<br>Van pool programs. residential areas and activity center (industrial plant, office complex, hospital or other health care facility, school, shopping center or district) | Residential areas and one or more activity centers (Central Business District, industrial plant or complex, office complex, school, hospital or other health care facility, shopping center) | Entire community | Selected residential areas and one or more activity centers (usually Central Business District) |
| 14. | Few-to-one<br>One-to-one<br>Few-to-few | Many-to-many<br>Many-to-few<br>Many-to-one<br>Few-to-few<br>Few-to-one<br>One-to-one | Many-to-many | Many to-many<br>Many-to-few<br>Many-to-one<br>Few-to-few<br>Few-to-one<br>One-to one |

TABLE IV-2 (Continued)

| Element of Transit Service | PARATRANSIT SERVICES | | |
|---|---|---|---|
| | Demand Responsive Transportation Services[1] | Jitney Services | Car Pool Services |
| 24. Operator | Texicab company or independent taxicab operetors<br>Municipal or county government<br>Municipal or county government in conjunction with taxicab compeny<br>Trensit authority or district<br>Social service orgenlzetion<br>Social service orgenization In conjunction with texicab company, municipal or county government, or transit authority or district | Independent entrepraneurs<br>Independent entrepranaurs orgenizad into e jitneymen's association<br>Taxicab company or indapendent texicab operators | Small groups of travelers<br>Small groups of travelers in conjunction with an amployer, the local governmant, or other organization that provides car pool matching services |
| 25. Control over routes, schedules, orlgins, and destlnations | User specifies route, schedule, origin, end destination (prearranged conventlonal texi)<br>User specifies schedule, origin, end destinetion (prearranged, meny-to-many, shared ride servica)<br>User specifies schedule end origin (preerranged, many-to-one, shared-rlde servlca)<br>Usar specifies origin end destinetion (many-to-many shered-rlde servica)<br>User specifies origin (many-to-one shared-rlde servica) | User has no control<br>User specifies destinetion (characteristic of jitnay services that daviata from routes) | Exarcised by car pool members |

[1]Demand-responsive transportation servicas include route daviation services, point devietion services, reguler texicab services, shared ride taxicab services, and dial-a-rida sarvicas.

TABLE IV-2 (Continued)

| Element of Transit Service | PARATRANSIT SERVICES | | |
|---|---|---|---|
| | Demand Responsive Transportation Services[1] | Jitney Services | Car Pool Services |
| 15. Eligible users | Anyone in service area (especially useful to physically impaired persons)<br>Designated persons only (typically the elderly or the handicapped or both) | Anyone able to reach the service (useful to workers of all incomes, businessmen, tourists, shoppers, school children, persons in low income areas) | Individual car pools restricted to small groups of people traveling at the same time between the same two vicinities or in the same direction (suitable for workers of all income groups, school children, elderly shoppers, handicapped, low-income shoppers) |
| 16. Eligible trips | Any trip purpose<br>Designated trip purposes only (e.g., only trips for appointments at hospitals and other medical facilities) | Any trip purpose (useful for work, business, shopping, school, and entertainment trips) | Individual car pools restricted to specific trip purposes (work, school, shopping) |
| 17. Hours of operation | 24-hour service<br>Daylight and evening hours<br>Midday and evening hours (off-peak only)<br>Daylight hours only<br>Evening hours only | 24-hour service<br>Daylight peak and off-peak hours (substitute for fixed-route, fixed-schedule bus)<br>Peak hours only (supplement fixed-route, fixed-schedule bus)<br>Daylight off-peak hours only (substitute for fixed-route, fixed-schedule bus) | Once during each peak hour<br>Any specified time |
| 18. Days of operation | 7 days a week<br>Weekdays and Saturday<br>Weekdays only | 7 days a week<br>Weekdays and Saturday<br>Weekends (substitute for fixed-route, fixed-schedule bus) | Every weekday<br>Any specified day |
| 19. Drivers | Independent of travelers<br>Full-time or part-time paid drivers or independent operators<br>Volunteer drivers (often used by services for the elderly, the handicapped, and other special groups) | Independent of travelers<br>Individual entrepreneurs<br>Full-time or part-time paid drivers<br>Commuters traveling to and from work | One of the travelers<br>Volunteer drivers |
| 20. Vehicles | Passenger cars<br>Station wagons<br>Limousines<br>Taxicabs<br>Vans<br>Small buses (buses seating less than 25 people)<br>NOTE: Vehicles may be either standard or otherwise modified | Vans<br>Small buses<br>Station wagons<br>Limousines<br>Taxicabs | Private passenger cars |
| 21. Association with other traffic | Operate in mixed traffic | Operate in mixed traffic | Operate in mixed traffic throughout a trip<br>Operate over exclusive lanes or rights-of-way separated from other traffic for portion of trip |
| 22. Pricing scheme | Flat fare<br>Graduated fare based on geographic zones<br>Graduated fare based on mileage (currently used by metered taxis)<br>Graduated fare based on mileage and time (currently used by metered taxis)<br>Free service (characteristic of many services for special groups) | Flat fare (plus incremental charge for route deviation)<br>Graduated fare based on geographic zones (plus incremental charge for route deviation) | Costs not shared by car pool members<br>Fuel costs shared by car pool members |
| 23. Method of payment | Cash for each trip<br>Exact fare for each trip<br>Tickets<br>Weekly or monthly passes<br>No payment necessary | Cash for each trip<br>Tickets | Share driving<br>Flat fare paid to driver or drivers<br>Any other method of sharing costs |
| 24. Operator | Taxicab company or independent taxicab operators<br>Municipal or county government<br>Municipal or county government in conjunction with taxicab company<br>Transit authority or district<br>Social service organization<br>Social service organization in conjunction with taxicab company, municipal or county government, or transit authority or district | Independent entrepreneurs<br>Independent entrepreneurs organized into a jitneymen's association<br>Taxicab company or independent taxicab operators | Small groups of travelers<br>Small groups of travelers in conjunction with an employer, the local government, or other organization that provides car pool matching services |
| 25. Control over routes, schedules, origins, and destinations | User specifies route, schedule, origin, and destination (prearranged conventional taxi)<br>User specifies schedule, origin, and destination (prearranged, many-to-many, shared ride service)<br>User specifies schedule and origin (prearranged, many-to-one, shared-ride service)<br>User specifies origin and destination (many-to-many shared-ride service)<br>User specifies origin (many-to-one shared-ride service) | User has no control<br>User specifies destination (characteristic of jitney services that deviate from routes) | Exercised by car pool members |

[1] Demand-responsive transportation services include route deviation services, point deviation services, regular taxicab services, shared ride taxicab services, and dial-a-ride services

TABLE IV-2 (Continued)

| Element of Transit Service | PARATRANSIT SERVICES | | CONVENTIONAL TRANSIT SERVICES | |
|---|---|---|---|---|
| | Van Pool Services | Bus Pool Services | Local Fixed Route Fixed Schedule Bus Services | Express Bus Services |
| | | Payroll deduction | | |
| 24. | Small groups of travelers in conjunction with an employer, social club or social service agency, private vehicle rental agency, or other organization | Organization of users in conjunction with public or private carrier or charter bus company (users' organizations include ad hoc committees, unincorporated association, and nonprofit corporations)<br>Organization acting as agent for groups of users in conjunction with public or private carrier or charter bus company (such organizations include community associations, large employers or coalition of employers, public or private transit operators, and noncarrier agencies engaged in promoting, organizing, and coordinating bus pools)<br>Combination of users' organization and agent in conjunction with public or private carrier or charter bus company | Private carrier<br>Municipal government<br>Transit authority or district | Private carrier<br>Municipal government<br>Transit authority or district |
| 25. | Exercised by van pool members | Exercised by users through their organization or agent | Exercised by the public or private carrier | Exercised by the public or private carrier |

TABLE IV-2 (Continued)

| Element of Transit Service | PARATRANSIT SERVICES | | CONVENTIONAL TRANSIT SERVICES | |
|---|---|---|---|---|
| | Van Pool Services | Bus Pool Services | Local Fixed Route Fixed Schedule Bus Services | Express Bus Services |
| 15. | Designated persons only (employees of particular firm, elderly, handicapped, school children) | Anyone in areas served able to use the service (primarily workers of any income group)<br>Designated persons only (employees of particular firm, elderly, handicapped, school children) | Anyone able to reach the service (primary markets are rush hour commuters to and from Central Business District and persons without access to an automobile) | Anyone able to reach and use the service<br>Primary market presently: suburban residents commuting to work in Central Business District<br>Potential market: Inner city residents for transportation to jobs in suburbs |
| 16. | Restricted to specific trip purposes (work, school, medical, shopping) | Restricted to specific trip purposes (work, school, medical, shopping) | Any trip purpose | No explicit restrictions: most suitable for shopping trips |
| 17. | Once during each peak hour<br>Any specified time | Peak hours<br>Any specified time | Daylight and evening hours<br>Daylight hours<br>Possibly 24 hour service | Peak hours<br>Daylight hours |
| 18. | Every weekday<br>Any specified day | Every weekday<br>Any specified day | Weekdays and Saturday<br>Weekdays<br>7 days a week | Weekdays |
| 19. | One of the travelers<br>Volunteer drivers | Independent of travelers: full-time or part-time paid drivers<br>One of the travelers | Independent of travelers: full-time or part-time paid drivers | Independent of travelers: full-time or part-time paid drivers |
| 20. | Vans | Buses of any size | Buses of any size | Buses seating more than 30 passengers |
| 21. | Operate in mixed traffic throughout a run<br>Operate over exclusive lanes or rights-of-way separated from other traffic for portion of run | Operate in mixed traffic throughout a run<br>Operate over exclusive lanes or rights-of-way separated from other traffic for portion of run | Operate in mixed traffic throughout a run<br>Operate over exclusive lanes or rights-of-way separated from other traffic for portion of run | Operate in mixed traffic throughout a run<br>Operate over exclusive lanes or rights-of-way separated from other traffic for portion of run |
| 22. | Flat fare<br>Graduated fare based on mileage<br>Free service | Flat fare<br>Graduated fare based on mileage<br>Free service | Flat fare<br>Graduated fare based on geographic zones | Flat fare<br>Graduated fare based on geographic zones |
| 23. | Weekly or monthly cash payments<br>Payroll deduction | Cash payment for each trip<br>Weekly, monthly, semiannual, or annual fare, fee, or membership dues<br>Tickets<br>Monthly pass<br>Payroll deduction | Exact fare for each trip<br>Tickets or tokens<br>Monthly passes | Exact fare for each trip<br>Tickets or tokens<br>Monthly passes |
| 24. | Small groups of travelers in conjunction with an employer, social club or social service agency, private vehicle rental agency, or other organization | Organization of users in conjunction with public or private carrier or charter bus company (users' organizations include ad hoc committees, unincorporated association, and nonprofit corporations)<br>Organization acting as agent for groups of users in conjunction with public or private carrier or charter bus company (such organizations include community associations, large employers or coalition of employers, public or private transit operators, and noncarrier agencies engaged in promoting, organizing, and coordinating bus pools)<br>Combination of users' organization and agent in conjunction with public or private carrier or charter bus company | Private carrier<br>Municipal government<br>Transit authority or district | Private carrier<br>Municipal government<br>Transit authority or district |
| 25. | Exercised by van pool members | Exercised by users through their organization or agent | Exercised by the public or private carrier | Exercised by the public or private carrier |

- van pools;
- bus pools;
- fixed-route, fixed-schedule (conventional) bus service; and
- express bus service.

Each of these basic options is discussed separately below.

a. Demand Responsive Transportation Services

The concept of demand responsive transportation encompasses a variety of transit services that respond to individual requests for service by continually adjusting their routes, their schedules, or both. The most familiar DRT service is the taxicab. There are many variations of DRT, however, and the names applied to them are almost as numerous as the variations themselves.

Most DRT services do not traverse fixed routes. The two exceptions to this are the modified forms of DRT known as route deviation and point deviation services. The vehicles in a route deviation system travel along fixed routes but, upon request, may deviate from a route within a specified maximum number of blocks. In a point deviation system, the vehicles must pass fixed checkpoints in succession but may follow any path between two checkpoints. The checkpoints are used to monitor the progress of the vehicles and to schedule the service.

Many DRT systems continually adjust their schedules in response to demand. Other systems operate on a fixed schedule by dispatching the vehicles at predetermined intervals, for example, every 30 minutes. This procedure both facilitates the dispatching function and increases each vehicle's productivity--by increasing the number of passengers in the vehicle in a given hour. Currently, those DRT systems that operate on a route or point deviation basis also operate on a fixed schedule.

Door-to-door service is a common characteristic of DRT services and is one of their most attractive features. While performing certain functions, however, some DRT systems provide doorstep service at only one end of the trip. Route and point deviation services may give the user a choice between having door-to-door service and walking to the nearest stop on a route or the nearest checkpoint.

Most versions of DRT provide shared-ride service. Taxicab service is a notable exception, although an increasing number of taxicab companies are now attempting to carry more than one passenger or fare at a time.

DRT services are normally requested by telephone. There are cases, however, in which the service can be obtained by hailing a vehicle or by being present at a designated location.

DRT systems differ in the types of reservation permitted. Some services allow their customers to request either immediate or deferred service, while others require their customers to telephone for service from 20 minutes to 1 or 2 days in advance. Many DRT systems offer a subscription service for trips taken on a regular basis. Riders are assured of having a seat, and there is usually ample space in the vehicles for storing personal belongings.

DRT systems can be classified as many-to-many, many-to-few, or many-to-one. Taking full advantage of its door-to-door capability, the many-to-many system transports people between any two points within a service area. This type of service is especially tailored to the prevailing diffused pattern of city travel characterized by trips between widely scattered, noncentral locations. The many-to-few system carries people from any point within its service area to only a few designated destinations. These destinations are typically major activity centers such as the CBD, shopping centers, schools, hospitals, and points of transfer to other vehicular modes of transportation. Many-to-one systems convey passengers between many locations and only one destination, often a place for transferring to another vehicular mode of transit. DRT systems that carry passengers to and from other transit services are known as feeder systems.

A major market for DRT services consists of persons who, for various reasons, do not have access to a private automobile. Because it provides door-to-door service, a DRT system is especially suitable for the physically handicapped and many of the elderly. The door-to-door service provided by a DRT system may also attract many automobile drivers. For example, persons who must commute from low-density residential areas near the edge of the community to jobs in the downtown area may decide to use a DRT feeder system to reach a line-haul transit system rather than drive to work.

Many-to-many DRT systems can be used for virtually any type of trip. This can be true of many-to-few and many-to-one systems, although the nature of their destinations may preclude certain types of

trips. Regardless of the number of origins and destinations served, DRT systems are more suitable for short trips. A large number of long trips can lower the system's productivity and increase the time spent waiting for the service and traveling in the vehicle.

DRT services are particularly appropriate during off-peak periods when the demand for travel is lighter and more diffuse. During midday, evening, and early morning hours and on weekends, a many-to-many DRT service can often substitute for a less flexible, fixed-route, fixed-schedule bus service. Many-to-few and many-to-one services can complement line-haul transit services during the rush hours and even in midday by operating as feeder systems. Thus, DRT services can often be made available 24 hours a day, 7 days a week.

Many types of vehicles--passenger cars, station wagons, taxicabs, vans, and small buses--can provide DRT service. To provide door-to-door service, the vehicles must be small; large vehicles cannot negotiate narrow residential streets easily.

Historically, DRT services, in the form of taxicabs, have been provided by private carriers. Recently, however, an increasing number of local governments and regional transit authorities have been operating shared-ride DRT services known as dial-a-ride. Many social service and health care agencies also provide highly specialized DRT services for their clients, who often need door-to-door service.

The flexibility of door-to-door service and the more personalized atmosphere of a DRT service generally give travelers more control over certain elements of the service than they normally have with conventional bus transit services. With DRT, users can usually travel to any place they desire at any time they choose.

The following examples of actual DRT systems illustrate the many possibilities of the DRT concept (data and statistics describing these and other DRT services are presented in Section VII of this manual). The examples are arranged in five categories: route deviation, point deviation, regular taxi, shared-ride taxi, and dial-a-ride.

### (1) Route Deviation

The most well-known route deviation DRT system was provided by a privately owned bus transit company in Mansfield, Ohio. The service was an extension of the regular fixed-route, fixed-schedule bus service and was only offered in the Woodland area, an upper middle class neighborhood, in an effort to increase the number of riders from

this area. Anyone in Woodland could either walk to the nearest bus stop or, for an additional 15 cents, telephone the bus driver and be picked up at his doorstep. Passengers could also receive doorstep service on the return trip to Woodland by notifying the bus driver and paying the additional fare. The bus company provided this service Monday through Saturday between 7:15 AM and 6:15 PM.

(2) Point Deviation

The City of Merrill, Wisconsin, operates the only known areawide point deviation DRT system. The vehicles in this sytem, small buses with telescoping lower front steps, make scheduled stops at fixed checkpoints but may travel along any path between two successive checkpoints in response to demand. Passengers may enter and leave a vehicle either at their doorstep or at the nearest checkpoint. The fare depends on the type of service used: 25 cents to travel between two checkpoints, 40 cents to travel from checkpoint to doorstep or vice versa, and 50 cents to travel from doorstep to doorstep. The service is shared-ride and many-to-many with no transfer required. It is available to anyone in Merrill, but its major markets are school children and senior citizens. It operates during the daylight hours every day of the week and on Friday evenings.

(3) Regular Taxi

Many if not most taxicab services carry only one passenger or group of passengers at a time in a vehicle, often because of restrictive local taxicab ordinances. These highly personalized services are so widespread that no specific examples need to be given. In small cities, taxi service is usually requested by phoning the cab dispatcher, although in the downtown area the service can often be obtained by hailing a cruising cab. Many taxicab companies maintain cab stands in densely populated areas or at major activity centers.

The conventional taxi is a many-to-many DRT service, often available at any time of day on any day of the week. Tripmakers can normally request either immediate or deferred service. Since the cabs carry only one passenger at a time, there are no intermediate stops. Many taxi operators, however, do offer group-ride service and charge group rates to two or more persons traveling together. Otherwise, the fare is normally based on mileage or a combination of mileage and time, although in a few cases it is based on zones.

Taxicab services are normally organized into one or more fleets under a single owner. Despite relatively high fares, they have been successful in part because of shrewd management and in part because of their highly personalized service, which gives travelers some degree of control over the service they receive.

(4) Shared-Ride Taxi

An increasing number of taxicab operators are providing shared-ride DRT service. A few of these shared-ride taxi systems existed before the transportation planning profession seriously considered the concept of demand responsive transportation. Many of the systems differ in one or more important respects. Table IV-3 presents a description of a selected set of shared-ride taxi services.

(5) Dial-A-Ride

Dial-a-ride is a term that has been applied to a variety of shared-ride DRT services operated by the public sector. These services utilize vans, small buses, or other vehicles larger than a taxicab, but in many respects they resemble a shared-ride taxi service. No two dial-a-ride systems are exactly alike. Table IV-4 presents a description of the types of dial-a-ride services being provided by small communities.

b. Jitneys

Jitneys are small buses and vans that carry several passengers at once along fixed routes on a variable schedule. They may stop either at any point to pick up anyone who hails them or at designated locations to pick up anyone waiting for them to arrive. Although they do not normally provide door-to-door service, they may depart a few blocks from a route near their terminus or along certain sections to deliver passengers either to their destinations or at least closer to their destinations. Because jitneys travel along fixed routes, they are not equally accessible from all locations, and passengers could conceivably have to transfer to another vehicular mode to complete a trip. Like conventional buses, jitneys carry many passengers at once, but under current laws and practices they do not permit standees. The service is not as personalized as a DRT system and may not be as comfortable or as convenient for carrying personal belongings.

Jitney operators are usually individual entrepreneurs who own their vehicles. They often form an association to protect their mutual interests and to regulate themselves.

## TABLE IV-3

## SHARED-RIDE TAXI SERVICES – SELECTED EXAMPLES

| Location | Description of Service |
|---|---|
| Davenport, Iowa | The shared-ride taxi system in Davenport provides many-to-many DRT service to an area encompassing over 20 square miles. The system operates 24 hours a day, 7 days a week, with a fleet of 20 to 22 Checker cabs. Customers request immediate or deferred service by telephoning the dispatcher's office. They may also choose between shared-ride service and regular taxi service, but, because the fare for the latter is much higher, there is virtually no demand for it. The fare schedule is based on a set of geographical zones. A group of passengers traveling together pays the same fare as a single passenger. |
| Stroudsburg, Pennsylvania | The taxicab company in this small community offers three types of service: regular taxi, immediate shared-ride taxi, and prearranged shared-ride taxi. Prearranged shared-ride taxi service is obtained by telephoning the dispatcher's office at least 2 hours in advance of the trip. By doing so, the traveler can ride between any two locations in the community for a flat fare of 50 cents. The fare for immediate shared-ride service is considerably higher and is based on a set of zones. Regular taxi service is the most expensive. |
| Arlington County, Virginia | The two largest taxicab companies in this suburban area near Washington, D.C., provide a novel many-to-few shared-ride taxi service. During weekday rush hours (7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM), the companies provide shared-ride service between any location in Arlington and two high-density employment areas. This service is designed primarily for commuters, who must telephone the dispatcher before 10:00 PM on the preceding evening to make a reservation. In the morning, the customers are picked up at their doorstep and taken to a cab stand in one of the two employment centers. In the evening, the taxis collect passengers at the cab stands and transport each rider to his or her home.<br>From 9:00 AM to 4:00 PM on weekdays, these two cab companies operate a shared-ride taxi service between any location in Arlington and one of four shopping centers in the area. Users must call at least 2 hours in advance to reserve a cab. The companies maintain a cab stand at each shopping center to collect passengers returning home.<br>These same two cab companies also provide an interesting subscription service to groups of two or more persons traveling together. This is a many-to-many group-ride service designed for trips taken on a regular basis. In effect, it is an alternative to a car pool. Each group informs the dispatcher of the days and times a taxi is needed, and the service is provided automatically. The cab company and the group negotiate the fare, which is based on the mileage involved. |
| Various | *Subsidized shared-ride taxi services.* Several small and medium-sized communities have contracted with taxicab operators to provide shared-ride service to special groups at a reduced fare. The broadest example of this service was implemented in *El Cajon and La Mesa, California,* where many-to-many shared-ride taxi service is |

TABLE IV-3 (Continued)

| Location | Description of Service |
|---|---|
| Various (Continued) | available to any resident at a reduced fare. In *Independence, Kansas, and Missoula, Montana,* subsidized many-to-many shared-ride taxi service is limited to the elderly, while in *Los Gatos and Sunnyvale, California,* such service is available only to the elderly and the less severely disabled. Reduced-fare shared-ride taxi service is provided to elderly persons with low incomes in *El Paso, Texas,* for essential medical trips and to elderly residents of *Arlington County, Virginia,* for any trip purpose except work and shopping. |

## TABLE IV-4

## DIAL-A-RIDE TRANSIT SERVICES – SELECTED EXAMPLES

| Location | Description of Service |
|---|---|
| La Habra, California | The publicly owned and operated dial-a-ride system in La Habra provides many-to-many shared-ride DRT service to a population of 47,000 over an area of 7 square miles. Users may request either immediate or deferred service and may subscribe to the service for habitual trips. There are no fixed routes and schedules, and no transfer is required for trips within the community. The system also functions as a feeder service to a line-haul transit system that reaches destinations outside La Habra. The service is available to anyone in the community for a flat fare. Children under 12 ride free if accompanied by a fare paying adult, and senior citizens can ride for half the regular fare. The fare is paid with either the exact amount of change or a ticket. The system operates every day except Sunday from 7:00 AM to 7:00 PM. |
| Regina, Saskatchewan | The Regina Telebus system functions primarily as a feeder to the local fixed-route, fixed-schedule bus system. It provides a many-to-few dial-a-ride service to low density residential areas in the southwest corner of the community. The service area is divided into zones, with one or more Telebus vehicles assigned to each zone. These vehicles, consisting of vans and small buses, circulate within their zones along unspecified routes at fixed time intervals determined by the headways on the fixed-route, fixed-schedule bus system. Customers are urged to call the dispatcher at least 20 minutes in advance. Bus riders can obtain Telebus service by boarding one of the vehicles at the transfer station where a Telebus vehicle from each zone is scheduled to meet each bus. |
| Ann Arbor, Michigan | The Ann Arbor Teltran system is another example of a dial-a-ride service that is integrated with a fixed-route, fixed-schedule bus service. On weekdays while the bus system is in operation, Teltran resembles a collection of miniature many-to-one feeder systems. The service area is subdivided into zones which together cover most of the community. Each dial-a-ride van tours its zone on a fixed schedule timed to enable the van to meet each bus at a transfer point on the edge of the zone. Because there are no fixed routes in any of the zones, the vans provide doorstep service to and from bus stops. The vans in three zones adjacent to the CBD also provide many-to-few service to several points in the downtown area.<br><br>At night and on weekends when the bus system does not operate, Teltran becomes an areawide many-to-many DRT service. In addition, the zones change, resolving into seven sectors radiating from the CBD. Because the vans tour their respective zones only once each hour, users must telephone the dispatcher at least 1 hour in advance. Unless both ends of the trip are in the same zone, the user must transfer to another dial-a-ride van in the CBD. |

TABLE IV-4 (Continued)

| Location | Description of Service |
|---|---|
| Ann Arbor (Continued) | Teltran charges a flat fare of 25 cents. Users may pay the exact fare for each trip or obtain an unlimited use monthly pass for $10.00. All elderly and self-certified low income residents can purchase these passes at half-price.<br><br>The Ann Arbor Transportation Authority, which operates Teltran, also provides dial-a-ride service to the handicapped. Several of the vans are equipped with wheelchair lifts. With this service, handicapped residents can travel door-to-door to any destination in the community. |
| Various | *Special Dial-a-Ride Services.* Because it provides door-to-door service, dial-a-ride is ideal for the handicapped, the elderly, and other transportation disadvantaged individuals. As described earlier, several taxicab companies across the nation are providing shared-ride and regular taxi service to these markets at reduced fares under contract with local governments. In addition, numerous social services agencies and quasi-public organizations are operating their own dial-a-ride services for these groups. The following are only a few examples.<br><br>*Whistlestop Wheels in Marin County, California,* is jointly sponsored by the Marin Senior Coordinating Council, the Volunteer Bureau of Marin County, and the Marin County Transit District. It consists of three programs. The senior citizens program provides free door-to-door transportation to the elderly for shopping, banking, medical appointments, educational programs, recreational activities, and evening meals at senior citizen centers. The medical transportation program is available free to the ill and the handicapped of all ages for medical trips. The third program furnishes transportation support to the Easter Seal Society and other service and charitable organizations. Whistlestop Wheels operates Monday through Saturday from 8:30 AM to 5:30 PM with a fleet of small buses, vans equipped to carry wheelchair users, and station wagons.<br><br>*In Chattanooga, Tennessee,* the Chattanooga Human Services Department provides a many-to-few DRT service to any resident who qualifies for publicly aided social services. The service can only be used for trips to social service and health service facilities. The Department manages a fleet of 17 radio-dispatched vans and station wagons.<br><br>*The City of Cranston, Rhode Island,* is operating a special many-to-many dial-a-ride service called Transvan under a demonstration grant from UMTA. Only residents of Cranston who are over 62 years old or handicapped and unable to use conventional bus transit are allowed to use this service. Eligible users are urged to make reservations at least 1 day in advance. In addition to the regular many-to-many service, Transvan also runs scheduled trips every week to several hospitals in nearby Providence and Warwick, to an enclosed shopping mall in Warwick, to recreational areas on Saturdays, and to Sunday morning religious services in Cranston. There is also a subscription service for the mentally retarded for daily trips to the center for the retarded. The system uses two small buses and a large bus equipped with a wheelchair lift. The Rhode Island Public Transportation Authority furnishes the drivers and maintains the vehicles. |

TABLE IV-4 (Continued)

| Location | Description of Service |
|---|---|
| Various (Continued) | Perhaps one of the most intriguing special dial-a-ride services is *Handicabs of Milwaukee, Inc.* Operated for profit by a handicapped entrepreneur, Handicabs offers a many-to-many, door-to-door service to handicapped residents in the five-county Milwaukee metropolitan area. Each van in the fleet is equipped to accommodate two or three wheelchairs. The system operates 7 days a week from 6:00 AM to 10:00 PM. Reservations are made by telephone, preferably 1 day in advance. The fare is $4.00 for the first 30 blocks and an extra 55 cents for each additional 10 blocks. |

In the heyday of the jitney, roughly between 1914 and 1920, many commuters offered ad hoc jitney service on their way to and from work as a means of paying for their automobiles. This idea of commuters providing jitney service is only now receiving some attention. If the small urban community were to provide jitney service, not just anyone would be allowed to become a jitney operator. Drivers would be screened carefully and would have to pay a yearly fee for registration and insurance. On their way to and from work, they would display a special flag, sign, or other emblem indicating their destination and would pick up any travelers heading in the same direction who hail them. To reduce the chances for robbery, users could pay for the service with redeemable tickets or coupons. There are, of course, many institutional barriers to be overcome before such services could be provided, but the concept has some potential for increasing the occupancy of private automobiles during rush hours.

Another potential provider of jitney services is the taxicab operator. During rush hours, regular taxicab service becomes more costly to provide because taxis are subject to the same traffic delays confronting private automobiles and therefore carry fewer riders than in less congested periods. Taxicabs might become more productive during peak periods if they could provide jitney services.

Jitneys have several possible applications. Because their seating capacity is small, they may be able to operate profitably along routes where the demand is insufficient for a regular bus service. Jitneys might be particularly suitable for crosstown routes. In small cities they could complement fixed-route, fixed-schedule bus service, particularly during the off-peak periods. Because jitney fares have tended to be as low as bus fares, jitneys can serve persons of any income level for work, shopping, business, school, and recreational trips along home-to-work, business, and commercial corridors.

Jitneys have several advantages which, in the past, enabled them to compete effectively with the fixed-route, fixed-schedule carriers. Although the jitneys were unscheduled, their headways were usually shorter than headways on the electric streetcar lines. The jitneys also provided a faster service because they required fewer stops to fill up the vehicle. They would often deviate from the main route for a few blocks to bring individual passengers closer to their destinations. Unsurprisingly, then, the jitneys attracted significant numbers of riders from the electric steetcars, whose representatives were successful in pressuring local governments to enact antijitney legislation that led to the virtual extinction of the jitney.

In 1976 there were only a few fully legal jitney operations in the United States; there were several more unlicensed ones. The largest number of jitney services are in Atlantic City, New Jersey; San Francisco; and Chattanooga, Tennessee.

The jitneys in Atlantic City operate continually along a major commercial, business, and tourist corridor. They carry primarily tourists, some service and office workers, and school children for trips to shops, restaurants, convention centers, places of entertainment, offices, and schools. The drivers are individual entrepreneurs banded together under a Jitneymen's Association which represents their collective interests and establishes work rules. The city issues jitney licenses for an annual fee of $85, limits the number of licensed jitneys to a maximum of 190, and sets the fare at 30 cents.

In San Francisco, approximately 116 jitneys operate along the 8 mile Mission Street route, passing through the downtown business and commercial areas and through low and middle income neighborhoods. The service is available 24 hours a day, seven days a week. As in Atlantic City, the drivers own and operate their own jitney vans, which seat 12 passengers. Roughly 90 percent of the drivers belong to the Mission Street Jitney Owners Association, which formulates the work rules. The San Francisco Board of Supervisors sets the fare at 30 cents for trips approaching the length of the route and 20 cents for shorter trips.

Unlike the jitneys in Atlantic City and San Francisco, the jitneys in Chattanooga, Tennessee, deviate from the one main route at the passenger's request and for an extra charge. As in Atlantic City and San Francisco, however, the 84 independent jitney drivers have formed a jitney owners association for political and economic reasons.

There are much smaller numbers of jitney operators in Chicago; Pittsburgh; Miami, Florida; and Anaheim, California. The jitney services in the first three cities operate in black ghetto areas, many of which are pooly served by regular bus transit. The jitneys in Anaheim travel along six fixed routes linking the baseball stadium, Disneyland, Knott's Berry Farm, and the commercial, hotel, and restaurant districts of Anaheim.

### c. Car Pools

Car pooling is one of several forms of travel in which a group of people agree in advance to ride together, usually on a regular basis. It is a transportation service the travelers themselves provide and control: together, the members of a car pool determine the schedule, the

route, the origins and destinations, the drivers, the automobiles to be used, the price, and the method of payment, if any. The obvious prerequisite for the formation of a car pool, therefore, is a small group of people who travel (usually for the same purpose) at the same time, in the same direction, and between the same general vicinities.

From the traveler's viewpoint, car pooling offers some advantages that conventional bus services do not: car pools are not constrained to any particular route; because car poolers can select alternate routes to avoid roadblocks, bottlenecks, and jams, car pools generally follow the fastest, most direct route between origins and destinations; and car pools can provide door-to-door service more easily. Other advantages include few, if any, intermediate stops, a seat for every passenger, and space for storing baggage.

One of the drawbacks of car pooling is the problem of scheduling. The extent of this problem depends on the nature of the trip. For work trips, the scheduled departure time will be inflexible, since it is determined by the car poolers' working hours. Whether this inflexible schedule becomes a problem or not depends on how rigid each car pool member's working hours are. If they frequently vary for one or more members, the fixed departure time becomes a serious limitation and may eventually dissolve the car pool. For shopping trips and other trips not rigidly bound to a schedule or to an appointment time, the departure time can be changed more easily.

The prospects for a car pool are best when its members live near each other and travel to the same destination. Conceivably, friends or acquaintances residing in widely separated areas or having widely separated destinations could form a car pool if their homes and destinations were roughly oriented in a straight line.

Car pools can be formed for any trip purpose, but the rush hour work trip is the most promising, both for forming car pools more easily and for reducing the negative effects of automobile travel in urban areas. According to the Federal Highway Administration (FHWA), the average auto occupancy for urban work trips is 1.6 persons per car. Nearly three-fourths of the automobiles used during rush hours for work trips carry only one occupant, the driver.[1] The FHWA estimates that increasing the auto occupancy of rush hour work trips by 30 percent from 1.6 to 2.1 would reduce the total vehicle-miles of travel by 22 percent and the

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[1]Alan M. Voorhees and Associates, Inc., Transportation Pooling (Springfield, Virginia: National Technical Information Service, 1974), p. 28.

consumption of gasoline by 5 percent.[1] The reduction in vehicle-miles of travel implies less traffic congestion, less pollution from automobile exhaust, and less demand for parking in crowded CBDs.

Car pooling can also benefit the elderly, the handicapped, and the poor. In the Shaw Urban Renewal Area of Washington, D.C., for example, 28 percent of the residents not owning automobiles used car pools for their weekly grocery shopping.[2] Many organizations, including local chapters of the American Association of Retired Persons, senior citizen centers, social clubs, churches, and social service health care agencies, can help the elderly and handicapped form car pools. Firms sponsoring car pool programs for their employees should give special consideration to handicapped employees.

A vast majority of car pools result from the initiative of the car pool members themselves without outside assistance and without any externally applied incentives; however, a growing number of major employers, both public and private, are now administering programs to help their employees organize car pools. The catalyst for these programs has often been a shortage of employee parking. As a result, many of the employers reserve choice parking spaces for car poolers as an incentive. Most of these employers use manual methods to match people who live within short distances of each other and who have the same working hours. A few, however, are using computerized techniques. Some of the major employers that have established car pool programs are the National Aeronautics and Space Administration in Washington, D.C.; the McDonnell-Douglas Corporation in St. Louis; the Connecticut Department of Transportation in Hartford; the Federal Highway Administration in Washington, D.C.; the Burroughs Corporation in Pasadena, California; the Hallmark Card Company in Kansas City, Missouri; and the Tennessee Valley Authority in Knoxville, Tennessee.

The employer-sponsored car pool programs have been so successful that many other groups are becoming involved in car pool programs for broader segments of the community. The private groups include chambers of commerce, television and radio stations, newspapers, auto clubs,

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[1]Lew Pratsch, "Carpools: The Underutilized Resource," Civil Engineering-ASCE, 44: 1, pp. 49, 51.

[2]Ronald F. Kirby, Kiran U. Bhatt, Michael A. Kemp, Robert G. McGillivray, and Martin Wohl, Para-Transit: Neglected Options for Urban Mobility (Washington, D.C.: The Urban Institute, 1974), pp. 228-229.

and voluntary, nonprofit organizations. Some of the public organizations engaged in car pool programs are transit authorities, councils of government, city planning or traffic departments, mayors' offices, county governments, the U.S. Department of Transportation, state departments of transportation, governors' offices, and regional transportation planning commissions. At least six cities are undertaking extensive programs: Knoxville, Denver, Dallas, Washington, Houston, and Los Angeles.

d. Van Pools

Van pooling is similar to car pooling in several respects. A van pool consists of a group of tripmakers who arrange to travel together regularly for a specific purpose. The route, schedule, origins and destinations, and other elements of the service are tailored to the particular needs of the group.

However, there are some important differences between van pooling and car pooling. Van pools consist of larger groups, they tend to be more formally organized, and they are normally sponsored by large employers, social service agencies, senior citizens centers, and other organizations. Although the drivers are usually members of the van pools, the company or organization sponsoring the service typically provides the vehicles, which they lease from a rental agency. Indeed, rental agencies and other transportation enterprises may find van pools to be a broad, attractive market.

Van pool services are not always door-to-door. Members may have to travel by some other vehicular mode to reach designated boarding points located near shopping centers, churches, and other places that have ample parking, and van pools organized for work trips may travel to several places of employment.

Some van pool services are provided free of charge, while others are priced on the basis of mileage. Two typical methods of payment are payroll deduction and weekly or monthly cash payments. The company or organization sponsoring the van pool program may sublease the vehicles to other groups, agencies, or organizations as a means of financing the service.

The primary markets for van pooling thus far have been commuters who must travel long distances to work. They are usually employees of a large company and have fairly rigid working hours. Other potential markets, some of which have been tapped only lightly, include the elderly, the handicapped, school children, and poor inner city residents seeking jobs in suburban areas.

Table IV-5 presents examples of selected van pool operations.

## TABLE IV-5

## VAN POOL TRANSIT SERVICES – SELECTED EXAMPLES

| Location | Description of Service |
|---|---|
| 3M Company in St. Paul, Minnesota | This company-sponsored van pool program, begun in March 1973, provides door-to-door transportation to workers traveling to and from the 3M Company's plant. The company furnishes the 12-passenger vans and provides free, convenient parking as an incentive. The drivers, who are selected company employees, ride for free and are allowed to use the vans on weekends and in the evenings at 7 cents per mile. When the number of riders in a van exceeds eight, the driver receives the fares of the additional passengers. This gives the driver an incentive to seek new van poolers from among his or her fellow employees. |
| Tennessee Valley Authority in Knoxville, Tennessee | The Tennessee Valley Authority (TVA) van pool program was implemented in April 1974 in response to the energy crisis that occurred during the preceding fall and winter months. The TVA Credit Union, a private agency, leases 12-passenger club wagons from a rent-a-car company and negotiates each rider's contract for service. The Vanpool Committee, consisting of three persons from the Credit Union and two from TVA, establishes the policies of the program, determines the fares and subleasing rates, and reviews the applications of prospective van pool drivers.<br><br>The van pools transport TVA workers living in widely scattered small towns in East Tennessee to TVA's offices in downtown Knoxville. The workers live as far as 50 to 60 miles away. Interested employees request the service by signing a contract with the Credit Union indicating their intention to ride in a van pool for at least 1 month. Most of the vans make several stops along the journey, loading or unloading the workers at designated locations along major highways. A few of the riders can walk to these locations, but most must travel by automobile. Only a small number of riders can board the vans in front of their homes.<br><br>Most of the TVA van pool riders were not totally dependent on the program for their transportation to work. Information about the earliest users indicates that over 80 percent had family incomes above $10,000 and over 90 percent had at least one automobile available for transportation to work. Before the van pool program was instituted, over 95 percent of the riders had traveled to work by automobile.[1]<br><br>The drivers are TVA employees given the responsibility of establishing and maintaining their respective van pools. In return, they receive free transportation to and from work and the right to use the vans after working hours at 7 cents a mile.<br><br>The monthly fare is based on miles traveled. The van poolers may pay by check, through payroll deduction, or through withdrawals from their Credit Union savings. To keep the fare as low as possible, the Credit Union subleases the vans to other agencies and groups during the day. |

[1] Frank W. Davis, Jr., Ridesharing and the Knoxville Commuter (Springfield, Virginia: National Technical Information Service, 1975), p. 76.

TABLE IV-5 (Continued)

| Location | Description of Service |
|---|---|
| **B&B Minibus Company in Nassau County, New York** | Under contract with Grumman Aircraft, the B&B Minibus Company, privately owned by a minority group, transports approximately 300 black trainees from their homes to the Grumman Aircraft plant in Nassau County on Long Island. Some of these trainees live as far as 60 miles from the plant. The service is free. |
| **Little House Senior Citizens Center in Menlo Park, California** | The Little House Senior Citizens Center operates its own van pool service three times a day to carry its members from their homes to the center. Ten members of the Center drive the vans on a rotating basis. The service is free. |

e. Bus Pools, Commuter Clubs, and Subscription Bus Services

If two to six persons in a residential area travel at the same time to a common destination, a car pool can be formed. If the number of people traveling at the same time from the residential area to a common destination or to the same general vicinity is between six and twelve, either several car pools or a van pool could be organized. When the number of residents with similar travel patterns exceeds the seating capacity of a van, either several carpools or van pools could be formed or a bus service could be provided. In the hierarchy of car pools, van pools, and bus pools, bus pools represent the highest level of transportation pooling.

The terms "bus pool," "commuter club," and "subscription bus" are often used interchangeably, but together they include several distinct types of service. All of these services, however, have a common feature which distinguishes them from bus service provided by private and public common carriers: each of these services is specifically designed to meet the articulated desires of a particular group of travelers. The users themselves specify many of the elements of the service, particularly the routes, schedules, places for boarding, and destinations. In this manual, such bus services will be referred to collectively as bus pools.

Bus pools are managed through a variety of interesting mechanisms. Typically, the users form their own organization or rely on an existing organization to act as their agent. The users' own organization may consist of the one individual responsible for initiating the project, an ad hoc committee, a more formal unincorporated association, or a nonprofit corporation. Existing organizations that could serve as the users' agent include community associations, large employers or a coalition of employers, transit operators (public or private) actively engaged in marketing special bus services, and noncarrier agencies engaged in promoting, organizing, and coordinating bus pools. Almost every existing special bus service has a unique organizational arrangement.

The users themselves seldom operate the service. In the past, local transit operators and charter bus companies have furnished the buses and the drivers. Local transit operators often assume much of the responsibility for managing the service as well as for providing it. When the buses are chartered, however, the users generally have a greater managerial role.

Although bus pools operate on fixed schedules, their departure times are more amenable than are those of regular bus services. During the first few weeks or months of operation, the users often make minor modifications in the schedule to accommodate as many people as possible. When more than one bus is used, the travelers usually set several alternative departure times.

Routes, although fixed at any one time, are also amenable to expeditious changes. The riders may initially experiment with several alternative routes to determine the fastest. They often designate one or more alternative routes to be taken when the primary route is unusually congested.

Bus pools seldom provide door-to-door service. Because of the large number of riders in a bus pool, such service entails too many stops and therefore consumes too much time. In addition, buses may be too large to operate on narrow, circuitous residential streets. However, many bus services closely approximate a door-to-door service by locating the bus stops within reasonable walking distances from most of the riders' homes and destinations. Alternatively, bus pools can provide only one or a few bus stops at accessible locations where there is ample parking space. Because most of the intermediate stops are concentrated at one or both ends of the run, regardless of the number of them, bus pools usually provide express service over a major portion of the trip.

Bus pools may stop at one, a few, or many destinations. The destinations are typically located at major centers of activity, such as manufacturing plants, industrial parks, office complexes, shopping centers, and transit stations, or they are located within large, densely populated commercial areas and areas of employment such as the CBD. To reach a destination not served by the bus pool, a rider may have to transfer to another vehicular mode of transportation. Some bus pool services arrange for free transfers for their riders.

The buses do not have to be parked at the destination or at the end of the run. If they are provided by a local transit operator, they can be used during the day to provide regular bus service. If they are chartered, they can be used to transport other groups during the day.

Bus pools must operate in mixed traffic while collecting and distributing passengers at the ends of a run. Over the line-haul portion of the run, however, they may travel along exclusive or reserved lanes on major streets and highways.

Bus pools may be either shared-ride or group-ride. In the case of a shared-ride bus pool, individual riders do not need a subscription or any other form of reservation to use the service. They may use it irregularly at their own option and pay for each trip separately. They may request the service simply by being present at a bus stop. In the case of a group-ride bus pool, the users must subscribe to the service by purchasing a weekly or monthly pass or by paying a fare calculated on the basis of daily usage over a period of time. In essence, each rider agrees to travel with the group on a regular basis. In either case, the users may not be guaranteed a seat on the bus; however, when the bus becomes overcrowded, additional ones are usually added.

Most bus pools are priced to break even, although they may be partially subsidized by an employer or other agent of the users. The most common types of fare are a flat fare and a graduated fare based on distance traveled. Methods of payment vary considerably and include paying cash for each trip; paying weekly, monthly, semiannual, or annual fare, fee, or membership dues; buying tickets or a monthly pass; and payroll deduction.

The principal markets for bus pools currently are persons who commute over 6 miles to work during the rush hours. Bus pooling is suitable for workers from any income bracket. One very beneficial application of bus pooling is the transportation of unskilled and semiskilled workers from the inner areas of the city to places of employment at the city's edge. The elderly and the handicapped constitute another market. Bus pools could be formed to transport groups of these people on a regular schedule to major shopping areas, grocery stores, recreational areas, health care facilities, social activities, church services, rehabilitation centers, and educational programs.

Table IV-6 gives examples which exemplify the variety of approaches to organizing, operating, and financing bus pools.

f. Fixed-Route, Fixed-Schedule Bus Service

Fixed-route, fixed-schedule (conventional) bus service is the most prevalent form of community-supported transit service. There are many reasons for the widespread popularity of this form of transit service, including the following:

- This mode of transit is one of the least expensive and easiest to operate.

## TABLE IV-6

## BUS POOL PROGRAMS – SELECTED EXAMPLES

| Location | Description of Service |
|---|---|
| **Specialty Transit Company in St. Louis** | The Specialty Transit Company of St. Louis is a privately owned carrier that transports McDonnell-Douglas Corporation employees between their homes and the plant, located in a northwestern suburb of St. Louis. The riders, mostly blue collar workers, live in 14 rural communities located 20 to 100 miles from the plant. The vehicles, which are used and remodeled school buses seating 41 passengers and a used rear-engine coach seating 50 passengers, travel along 21 fixed routes, stopping en route to collect and discharge riders at designated park-and-ride lots. The riders therefore must use another vehicular mode of transportation, usually their own automobiles, to reach the buses. The fare is based on the distance traveled while riding in a bus. The McDonnell-Douglas Corporation gives the buses priority at all intersections within the plant and provides convenient parking spaces for the buses.<br><br>Specialty Transit's subscription bus service is one of the few bus pools in which the drivers are also members of the pool. They are employed part-time by the carrier and are paid only for the actual driving time to and from the plant. |
| **Premium Special in Peoria, Illinois** | The Premium Special subscription bus service was begun as a federally funded demonstration project in December 1964 to transport employees of Caterpillar Tractor Company between their homes and the manufacturing plant. The service eventually grew to include 21 routes, which together covered the entire community. The equipment consisted of 15-year-old remodeled school buses seating 36 to 45 passengers. Although door-to-door service was not provided, most of the riders lived within 1/8 mile from one of the many bus stops. Routes and schedules were modified frequently to accommodate new users. Fares were based on the distance between the plant and the workers' homes. Interested workers had to subscribe to the service and rode with virtually the same group every day. The typical user was a male who owned an automobile and had a yearly income of $9,000. The ridership rose from 30 subscribers at the start of the demonstration to 500 subscribers in February 1966, when the service was handed over to the local transit operator, a private carrier, to manage and operate. The transit company caused the ridership to decline by increasing the fares and eliminating several routes and discontinued the service in 1970. |
| **Reston, Virginia, Commuter Bus Club** | The express bus service between Reston, Virginia, a new town, and Washington, D.C., is one of the more celebrated user-managed services of its kind. Because of its success in attracting riders, the service grew so large that, to manage it, the users formed a nonprofit corporation comprised of volunteers. Reston Commuter Bus, Inc. (RCB) prepares and distributes schedules, prints ticket books, conducts |

TABLE IV-6 (Continued)

| Location | Description of Service |
|---|---|
| Reston, Virginia (Continued) | surveys of the riders, handles all negotiations with the bus operator, and determines the fare. The buses and drivers are provided by Colonial Transit, Inc. One rider on each bus is designated the "busmeister" by RCB's Board of Directors. The busmeister's duties include selling ticket books, collecting tickets, depositing the receipts into RCB's bank account, recording the number of riders, attending board meetings, and being a spokesman for the riders. For their services, the busmeisters ride for free.<br><br>Reston's commuter bus system is neither a group-ride service nor a subscription service. The residents may use it on any weekday by simply being present at one of the numerous bus stops. In the morning, the buses circulate through the community, collecting passengers at the bus stops, and proceed nonstop to numerous destinations in the commercial and governmental districts of Washington, D.C. This sequence is reversed in the evening. The buses begin their runs at different times to accommodate as many people with different work schedules as possible. A "straggler" bus was added in the evening to collect late workers. Although this bus seldom carries enough passengers to be self-supporting, its inclusion caused the ridership on the regular buses to increase by 80. The routes and schedules are occasionally revised by RCB following surveys of the commuters. The passengers pay for each one-way trip with cash or with a ticket. Commuters wishing to subscribe to the service may purchase weekly passes. |
| Columbia, Maryland, Commuter Bus Club | The user-managed express bus service between the new town of Columbia, Marymand, and Washington, D.C., operates very similarly to the one in Reston, although the management of the service differs slightly. In Columbia a five-member Bus Service Board handles the financing, scheduling, and promotion of the service, and the Columbia Association, a citizens organization that promotes and provides services not provided by the county government, monitors the charter contract and certifies the bills. As in Reston, bus captains are appointed to sell and collect tickets, answer questions, and distribute schedules on each bus. The buses are chartered from a private charter bus company. |
| Various | *Other Commuter Bus Clubs. The Golden Gate Bridge, Highway, and Transportation District (GGBHTD) in San Francisco* obtains buses and drivers from sightseeing and charter bus companies through bids and leases them to five separate commuter clubs, organized groups of travelers, in Marin and Sonoma Counties. The commuter clubs determine the routes and schedules and use the buses for work trips to downtown San Francisco. The GGBHTD permits the commuter clubs to use the exclusive bus lane on the approach to the Golden Gate Bridge and allows free passage over the bridge.<br><br>Another commuter-managed bus service operates between *Murraysville, Pennsylvania, and downtown Pittsburgh.* This is a group-ride, subscription bus service in which the users pay a flat monthly fare in advance. The bus run begins at a park-and-ride lot in Murraysville and ends with several stops in downtown Pittsburgh. The commuters specify the morning and evening rush hour departure times, the route (including alternate routes), and the downtown stops. The commuters charter a bus from the Port Authority of Allegheny County. |

## TABLE IV-6 (Continued)

| Location | Description of Service |
|---|---|
| Various | *Employer-Sponsored Bus Pools.* Several public and private employers either sponsor or provide express bus service for their employees.<br><br>When the *National Geographic Society* moved its bindery from *northeast Washington, D.C., to suburban Gaithersburg, Maryland,* there was considerable concern over the ability of the low-skilled, low-income employees living in the vicinity of the old plant to reach the new facility. The Society leased some buses from a charter bus company to transport these people to and from work for a nominal fare. The users pay their share of the cost of the service through payroll deduction.<br><br>*The Government Employees Insurance Company in Chevy Chase, Maryland,* transports many of its employees by bus from several outlying shopping centers.<br><br>*The Atlantic Richfield Company* subsidizes the provision of bus transportation services for its employees between *several residential areas and the Atlantic Richfield Plaza in downtown Los Angeles.* The users pay a monthly charge for this service.<br><br>*The Southern Athletic Company in Knoxville, Tennessee,* encountered the problem of transporting some of its employees to its new plant at the edge of the city. Many of its employees lived in the vicinity of the old plant near the city's center and lacked personal transportation. The company purchased a 40-passenger school bus and began transporting these people from the former plant site to the new plant for a flat weekly fare. The driver is an employee of Southern Athletic.<br><br>*In Pittsburgh,* three major companies, after relocating to the downtown area, chartered buses from the Port Authority of Allegheny County to transport some of their employees to and from work.<br><br>*COM-BUS, the Southern California Commuter Bus Service, Inc. (in Los Angeles)* is a private corporation engaged in the business of forming bus pools. The company matches commuters with common origins and destinations and common work schedules, establishes routes and schedules after surveying commuters, collects fares, leases buses from charter bus companies, negotiates with the Public Utilities Commission concerning certification and fares, and handles complaints from passengers. The users subscribe to the service by paying a weekly fee. COM-BUS leases only late-model, air-conditioned coaches with reclining seats. The buses transport groups of commuters from *residential areas in Orange County and the San Fernando Valley to work locations near Los Angeles International Airport.* COM-BUS is considering an expansion of its services to include government workers traveling to the civic center in downtown Los Angeles from any residential area in Los Angeles and Orange County. |

- In many large urban areas, this form of transit service is required to move the many residents who commute between residential suburbs and the CBD.

- An established route network and a regular service schedule encourage repeated use of the transit service.

- This type of service is characterized by high initial dependability because fixed routes become familiar to drivers quickly. Efficiencies in operation are therefore realized early in the system's development period.

- With standard-sized buses, this mode of transport can accomodate very high volumes of traffic along densely developed corridors.

Despite these advantages, local fixed-route, fixed schedule bus services generally impose more constraints on travelers than do any of the other transit services described thus far. For example, fixed-route, fixed-schedule bus service is generally not designed to provide many-to-many service throughout a small city, although this is often one of its purposes. The fixed routes are not equally accessible from all parts of the community. Studies have shown that most bus riders will not walk more than 0.4 to 0.6 miles to a bus stop.[1] For longer distances, some other vehicular mode of transportation may be required to reach the bus service. Since the bus routes in small cities tend to be oriented toward the downtown area, bus trips between two points outside this area can be very time-consuming if not impossible to make, and they often require a transfer between vehicles. Such trips can usually be made much more quickly by private automobile or by taxi. Fixed routes, which imply the absence of door-to-door service, can therefore severely restrict the ability of a local bus system to serve all of the locations in a community.

Fixed routes and schedules are not undesirable in themselves: successful bus pools and van pools operate in this fashion. The routes and schedules followed by bus pools and van pools, however, are devised to meet the needs of a particular group of travelers for a specific

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[1] Institute of Traffic Engineers, Transportation and Traffic Engineering Handbook (Englewood Cliffs, New Jersey: Prentice-Hall, 1976), p. 230.

trip purpose, whereas bus systems for the general public offer the same service to all people for all types of trips. To request this type of service, users must reach the nearest bus stop, a requirement which is an obstacle for people who have difficulty walking even a few blocks (e.g., the physically handicaped and some elderly residents), and to complete a trip the bus rider may have to transfer to another bus. The potential for numerous intermediate stops increases the amount of time required to complete a trip, particularly for trips covering long distances. Finally, a seat is not always guaranteed, there are no special provisions for storing personal belongings, and personal assistance is not usually available to persons hampered by physical defects, personal belongings, or small children. These characteristics contrast sharply with those of the private automobile and have undoubtedly contributed to the 90.5 percent decline in conventional bus transit ridership between 1945 and 1973 in cities with 50,000 to 250,000 population.[1]

Normally the hours and days of operation vary among different fixed-route, fixed-schedule bus systems. In many small cities, bus service is not available in the evenings or on Sundays and holidays because of insufficient demand. Bus service on Saturdays is often sharply curtailed for the same reason.

The most common pricing schemes for this type of service are the flat fare and a graduated fare based on geographical zones. Most conventional bus transit systems require exact fares, although many now sell tickets and monthly passes. Reduced fares for the elderly, the handicapped, and school children are also becoming more common.

Buses normally operate in mixed traffic, although several cities with more than 250,000 population have designated reserved lanes for buses on segments of certain major streets to separate buses from other vehicles. This increases the overall speed of the bus service but may not be warranted in smaller cities, where traffic congestion is not as heavy, the peak periods are shorter, and the number of buses is smaller.

Most conventional bus transit systems use vehicles which seat more than 30 passengers. However, smaller buses are becoming more popular, particularly in small cities. In 1973, 5.7 percent of the new buses delivered to transit operators seated less than 30 passengers, compared to 4.3 percent in 1972 and 3.8 percent in 1971.[2]

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[1] American Public Transit Association, '74-'75 Transit Fact Book (Washington, D.C.: American Public Transit Association, 1975), p. 14.

[2] Ibid., p. 28.

An increasing number of fixed-route, fixed-schedule bus systems are being provided by the public sector. In 1959 only 4 percent of all local bus, rail rapid transit, and trolley car systems were publicly owned;[1] by 1974 this percentage had increased to approximately 33 percent.[2] Still two out of every three local bus systems were privately owned and operated, although private companies owned only 23 percent of the buses operating in American cities.[3] Declining ridership and rising costs have driven many private operators out of business. Many, but not all, of these systems were absorbed into the public sector.

The two most significant markets for fixed-route, fixed-schedule bus service are the commuters who journey to and from work in the CBD during the peak periods and the captive riders, i.e., persons who do not have access to a private automobile. Relative to the general population, intracity buses transport disproportionately large numbers of the elderly and the urban poor.

g. Express Bus Services

As mentioned in the preceding section, because of the frequent stops made by the bus, trips by fixed-route, fixed-schedule bus usually require much more time than do corresponding trips by private automobile. The disparity between auto and bus travel times becomes greater as the length of the trip increases. The people most affected by this characteristic of local bus service are those who live near or beyond the outer terminus of a bus route. To make bus transportation more attractive to these residents, bus operators in increasing numbers are providing nonstop express bus service between suburban residential areas and the CBD.

In the strictest sense, express bus service is nothing more than a fixed-route, fixed-schedule bus service with a limited number of intermediate stops. Unlike the more general form of bus service, however, express bus services are designed to serve a much narrower market. Many of the bus pools, commuter clubs, and subscription bus services described previously were express bus services. The principal difference

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[1] Institute for Defense Analyses, Economic Characteristics of the Urban Public Transportation Industry (Washington, D.C.: U.S. Government Printing Office, 1972), p. 24.

[2] American Public Transit Association, op. cit., p. 9.

[3] Ibid., p. 11.

between these services and the express bus services discussed in this section is that the elements of the express bus services--the routes, schedules, origins and destinations, and so on--are prescribed by the carrier rather than by the users.

Express bus services differ primarily in the number of stops made at each end of the run. The buses may circulate through a residential area and collect passengers at several or many locations, or they may begin the run at a conveniently located park-and-ride lot (often at a large shopping center). Similarly, at the opposite end of the run (in the CBD), the buses may make one, a few, or many stops. While collecting and distributing passengers at the ends of the run, the buses normally operate in mixed traffic. During the express portion of the journey, however, they may operate on exclusive rights-of-way, separated from other vehicular traffic. There are numerous examples of this type of operation in urbanized areas with more than 250,000 population.[1]

Currently, peak-hour work trips between suburban residential areas and the downtown area, which are often more than 7 miles long, constitute the primary market for express bus service. Express bus service could also be used to transport inner city residents to jobs in the suburbs or at the outer edge of the city.

Express bus services are less common now in urbanized areas with less than 250,000 population than in larger urbanized areas. Knoxville, Tennessee, is an excellent example of one small city that has this type of transit service. In August 1974, express buses began operating in this community along six routes linking the CBD with suburban residential areas to the west, northwest, and north. These residential areas were between 6 and 13 miles from the CBD. The buses began their runs at park-and-ride lots and proceeded nonstop to a few destinations in the downtown area. Only one bus run was made over each route during the morning and evening peak periods.

3. Summary

Two important points emerge from the above description of possible transit services. First, although no single transit service is

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[1] Wilbur Smith and Associates, Bus Use of Highways: State of the Art, National Cooprative Highway Research Program Report 143 (Washington, D.C.: Transportation Research Board, 1973), pp. 84-329.

sufficient for meeting every conceivable transportation need in a small city, one transit operator can provide several transit services using the same equipment. For example, the manager of a taxicab fleet can provide (1) traditional taxicab service in which only one passenger at a time is transported in a cab, (2) immediate and prearranged shared-ride taxi services, (3) services similar to car pooling for small groups of travelers, (4) subscription taxi service, (5) feeder service to local and express bus services, (6) publicly subsidized services for the elderly, the handicapped, school children, and, possibly, other transportation disadvantaged people, (7) goods delivery, and (8) jitney service. As another example, the bus transit operator can (1) offer traditional bus service in densely traveled corridors, (2) provide express bus service to long-distance commuters, and (3) furnish buses to organized groups of travelers for the groups' own purposes. Through innovation, the transit operator in both the public and the private sector can serve many markets for transportation.

The second point that emerges from the above description of possible transit services is that the private sector--including not only the various carriers but also private citizens, businesses, and organizations not engaged in the business of transportation--can play an important role in the provision of transit services. Some of the more successful and innovative transit services have been conceived, designed, implemented, and managed by groups of travelers or their agents. These services were often developed because the public and private carriers either could not or would not provide a service that met the consumers' needs.

Short-range transit planning is not simply the process by which a choice between a demand responsive transportation service; a fixed-route, fixed-schedule bus service; or other categories of transit service is ultimately made. Rather, it is the process of matching the elements of a transit service with the transportation needs of specific markets and should determine both the appropriate mix of transit services and the mechanisms for coordinating these services.

### 4. Selecting Transit Service Alternatives for Evaluation

The small urban community can assume three roles in transit service development. First, it can promote transit services by providing incentives for organizing car pool and van pool programs, relaxing regulatory constraints on taxicab operations, and committing public relations resources to enhance the image of local transit services. Second, it can sponsor transit services by providing financial subsidy assistance or planning, administrative, and technical support to transit operations. Finally, the small urban community can itself become directly involved in the provision of transit services. Each of these roles represents a different degree of community involvement in, responsibility for,

and control of transit services, and each consequently represents one element of the basic description of a transit service alternative for the small urban community. The major issues involved in determining the appropriate degree of community control over transit services are discussed in Section VI.B of this manual.

In addition to these issues, there are three basic considerations in selecting a set of transit service alternatives for evaluation:

1. the objectives of the transit service;

2. the capabilities of various transit service alternatives; and

3. the financing capabilities and commitments of the small urban community.

Often the most important consideration is the last, for without local financial support many transit services simply cannot be provided. It is essential, therefore, that the small urban community planner and decisionmaker attempt to determine early in the planning process the level of financial support the community is willing to provide for transit service. This level, however, should not necessarily become an inviolate constraint on the development of transit service alternatives.

If the objectives of transit service are rational and transit service alternatives are logically developed and evaluated, a reasonable finacing program can also be developed. Public acceptance of a financing program is more likely to be developed than discovered, and it can best be developed if the financing program itself is sound, reasonable, and carefully explained and if its purpose is justified by rational analysis of alternatives.

The principal considerations in the development of transit alternatives for evaluation and implementation, therefore, are the objectives to be achieved by implementing or expanding transit service and the capabilities of various transit service alternatives. To assist with the selection of basic transit options for consideration by a small urban community, Table IV-7 presents a summary of typical environments suitable for the implementation of each of the seven basic service types discussed earlier.

Once a set of basic transit service alternatives has been selected for consideration by the small urban community, the basic elements of each service alternative should be described. Typical characteristics of

## TABLE IV-7

## ENVIRONMENTS SUITABLE FOR THE IMPLEMENTATION OF SEVEN BASIC TRANSIT ALTERNATIVES APPROPRIATE FOR CONSIDERATION IN SMALL URBAN COMMUNITIES

| TRANSIT ALTERNATIVE | ENVIRONMENT |
|---|---|
| **Paratransit Services** | |
| Demand Responsive Transportation (DRT) Services | DRT services can be provided throughout a community or in selected areas. They have been recommended for areas with densities of 4,000 to 8,000 persons per square mile, although they have operated in areas with population densities under 1,000 and over 10,000. The practical limits to the size of a DRT system's service area have often been stated to be 2 and 6 square miles. Many taxicab services, however, including a few shared-ride taxi enterprises, cover areas greater than 20 square miles. Nevertheless, DRT systems are particularly suitable for low-density areas where buses on fixed routes and schedules have traditionally been unable to operate successfully.<br><br>A major market for DRT services consists of persons who, for various reasons, do not have access to a private automobile. Because it can provide door-to-door service, a DRT system is especially suitable for the physically handicapped residents of a community.<br><br>Many-to-many DRT systems can be used for virtually any type of trip. The same may be true of many-to-few and many-to-one systems, although the nature of their destinations may effectively preclude certain types of trips. Regardless of the number of origins and destinations served, DRT systems are more suitable for short trips. A large number of long trips can lower the system's productivity and increase the time spent waiting for the service and traveling in the vehicle.<br><br>DRT services are particularly appropriate during off-peak periods when the demand for travel is lighter and more diffuse. During midday, evening, early morning, and weekends, a many-to-many DRT service can often substitute for a less flexible, fixed-route, fixed-schedule bus service. Many-to-few and many-to-one services can complement line-haul transit services during the rush hours and even in midday by operating as feeder systems. DRT services can therefore often be made available 24 hours a day, 7 days a week. |
| Jitney Services | Jitneys have several possible applications in small urban communities. Because their seating capacity is small, they may be able to operate profitably along routes where the demand is insufficient for a regular bus service. Jitneys might therefore be particularly suitable for crosstown routes. In small cities they could also complement fixed-route, fixed-schedule bus service, particularly during the off-peak periods. Because jitney fares have tended to be as low as bus fares, jitneys can serve persons of any income level for work, shopping, business, schools, and recreational trips along home-to-work corridors and along business and commercial corridors. |

TABLE IV-7 (Continued)

| TRANSIT ALTERNATIVE | ENVIRONMENT |
|---|---|
| **Paratransit Services (Continued)** | |
| **Car Pool Services** | One obvious prerequisite for the formation of a car pool is a small group of people who travel at the same time and in the same direction or between the same general vicinities, usually for the same purpose.<br><br>The prospects for a car pool are best, however, when its members live near each other and travel to the same destination, although friends or acquaintances residing in widely separated areas or having widely separated destinations could conceivably form a car pool if their homes and destinations were roughly oriented in a straight line.<br><br>Car pools can be formed for any trip purpose, but the rush hour work trip is the most promising, not only for forming car pools more easily but also for reducing the negative effects of automobile travel in urban areas.<br><br>A vast majority of car pools result from the initiative of the car pool members themselves without any outside assistance and without any externally applied incentives; however, a growing number of major employers, both public and private, are now administering programs to help their employees organize car pools. The catalyst for these programs has often been a shortage of employee parking. |
| **Van Pool Services** | Van pooling is similar to car pooling in several respects. A van pool consists of a group of tripmakers who arrange to travel together regularly for a specific purpose. The route, schedule, origins and destinations, and other elements of the service are tailored to the particular needs of the group.<br><br>There are, however, some important differences between van pooling and car pooling. Van pools consist of larger groups. They tend to be more formally organized and are normally sponsored by large employers, social service agencies, senior citizens centers, and other organizations.<br><br>The primary markets for van pooling thus far have been commuters who must travel long distances to work. They are usually employees of a large company with fairly rigid working hours. Other potential markets, some of which have been tapped only slightly, include the elderly, the handicapped, school children, and poor inner-city residents seeking jobs in suburban areas. |
| **Bus Pool Services** | If two to six persons in a residential area travel at the same time to a common destination, a car pool could be formed. If the number of people traveling at the same time from the residential area to a common destination or to the same general vicinity is between six and 12, either several car pools or a van pool could be organized. When the number of residents with similar travel patterns exceeds the seating capacity of a van, either several car pools or van pools could be formed or a bus service could be provided. In the hierarchy of car pools, van pools, and bus pools, the bus pool represents the highest level of transportation pooling. |

TABLE IV-7 (Continued)

| TRANSIT ALTERNATIVE | ENVIRONMENT |
|---|---|
| **Paratransit Services (Continued)** | |
| Bus Pool Services (Continued) | The principal markets for bus pools currently are persons who commute over six miles to work during the rush hour. Bus pooling is suitable for workers from any income bracket. One very beneficial application of bus pooling is the transportation of unskilled and semi-skilled workers from the inner areas of the city to places of employment at the city's edge. The elderly and the handicapped constitute another market. Bus pools could be formed to transport groups of these people on a regular schedule to major shopping areas, grocery stores, recreational areas, health care facilities, social activities, church services, rehabilitation centers, and educational programs. |
| **Conventional Transit Services** | |
| Local Fixed-Route, Fixed-Schedule Bus Services | The two most significant markets for fixed-route, fixed-schedule bus service are (1) the commuters who journey to and from work in the Central Business District during the peak periods and (2) *captive* riders (persons who do not have access to a private automobile). Relative to the general population, intracity buses transport disproportionately large numbers of the elderly and the urban poor. |
| Express Bus Services | Unlike the more general form of conventional bus service, express bus services are designed to serve a much narrower market. Many bus pools, commuter clubs, and subscription bus services provide express bus services.<br><br>Currently, peak-hour work trips between suburban residential areas and the downtown area, often more than 7 miles long, constitute the primary market for express bus service. Express bus service could also be used to transport inner-city residents to jobs in the suburbs or at the outer edge of the city.<br><br>Express bus services are rarely operated in urbanized areas with less than 250,000 population. |

the seven basic transit alternatives suitable for consideration by a small urban community have been described in terms of 25 elements of transit service and presented in Table IV-2.

Many elements of a transit service are a logical requirement of the transit market to be served and the objectives of the transit service. For example, if the objective of transit service is to provide transportation for elderly and handicapped residents making shopping trips, personalized assistance and package space are two essential elements of the transit service. These elements of transit service are typically represented by only two options.

However, some elements of transit service, while still related to the requirements of transit markets and the objectives of the transit service, can assume a wide range of values, often for each of the options which characterize the individual elements of a particular service option. For example, if fixed schedules are selected as one element of a transit service alternative, the precise schedule itself must be specified to fully define the alternative. A transit service offering vehices at a regular rate of two per hour at a specific location differs substantially from one that offers vehicles at a regular rate of four per hour at that location.

For guidance in preparing the practical design of transit alternatives in terms of these elements, small urban community planners and decisionmakers should consult the following publications:

1. Transportation System Management: A Bibliography of Technical Reports, prepared by Richard L. Oram, Urban Mass Transportation Administration, Office of Policy and Program Development, U.S. Department of Transportation, 400 Seventh Street, S.W. Washington, D.C. 20590, May 1976.

   available from National Technical Information Service (NTIS)
   Springfield, Virginia 22161

   ordering information: PB 257 273

2. Smerk, G. M., et al, Mass Transit Management: A Handbook for Small Cities, Bloomington, Indiana: Indiana University.

   available from: NTIS cite: PB 222 386

3. Suen, L., et al., Dial-a-Bus Manual, Volume II., Montreal: Transport Canada Transportation Development Agency, 1974.

   may be obtained by contacting:

   Ling Suen (514) 283-7504
   Project Officer
   Transportation Development Agency
   Ministry of Transport
   1000 Sherbrooke West
   Montreal, Quebec, Canada 43A 2C3

4. Arrillaga, B. and Mouchahoir, G. E. (MITRE Corporation), Demand Responsive Transportation: System Planning Guidelines, prepared for the Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, D.C., April 1974.

   available from NTIS

   cite PB 232 970

5. Alan M. Voorhees & Associates, Inc., Short-Range Transit Planning, prepared for the Office of the Secretary and the Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, D.C., July 1973.

   available from NTIS cite PB 226 482

   --or--

   Superintendent of Documents
   U.S. Government Printing Office
   Washington, D.C. 20402

   cite: 5014-00002
   TD 7.2:T68

6. Federal Highway Administration, U.S. Department of Transportation and the Highway Users Federation, How to Pool It: A Ride Sharing Manual for Employers, Washington, D.C., May 1975.

   available from: U.S. Department of Transportation
   Federal Highway Administration
   Traffic Engineering Branch
   Washington, D.C. 20590
   (202) 426-0210

7. Forstater, I. and Twomey, E. (U.S. Environmental Protection Agency, Office of Transportation and Land Use Policy), Van Pooling: A Summary and Description of Existing Van Pool Programs, Washington, D.C., January 1976.

available from: U.S. Environmental Protection Agency
Office of Transportation and Land Use Policy
AW 445
401 M Street, S.W.
Washington, D.C. 20460
(202) 755-0603
ATTN: Edward Twomey

8. Miller, G. K. and Green, M. A. (Urban Institute), Guidelines for the Organization of Commuter Van Programs, prepared for the Office of Service and Methods Demonstrations, Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, D.C., February 1976.

available from NTIS cite: PB 252 305

9. Grey Advertising, Inc., and Chase, Rosen & Wallace, Inc., Pricing: A Transit Marketing Management Handbook, prepared for the Office of Transit Management, Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, D.C., April 1976.

available from:

U.S. Department of Transportation
Office of Transit Management, UMD-20
Urban Mass Transportation Administration
Washington, D.C. 20590
ATTN: Carol Passen

10. User Information Aids: A Transit Marketing Management Handbook, prepared for the Office of Transit Management, Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, D.C., November 1975. Ilium Associates, Inc.

available from:

U.S. Department of Transportation
Office of Transit Management, UMD-20
Urban Mass Transportation Administration
Washington, D.C. 20590
ATTN: Carol Passen

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